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LAWNS

AND

SPORTS GROUNDS'

By SUTTON'S
of READING

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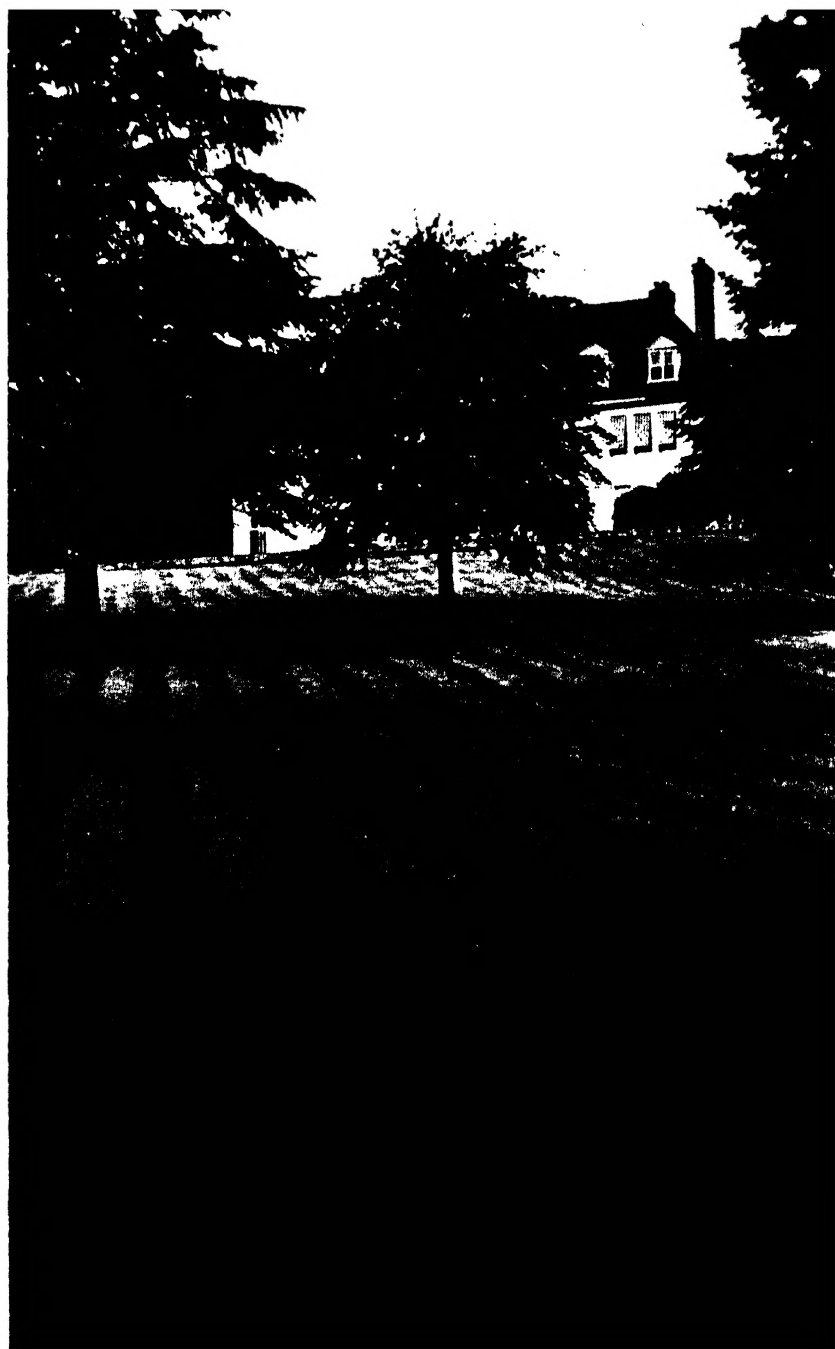
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LAWNS

CHAPTER ONE

NEW LAWNS

A WELL-KEPT LAWN is an essential feature of every garden. So deeply is the charm of the lawn implanted in the heart of garden lovers, that even in the most unfavourable regions of the world great efforts are made to establish lawns by the use of wild grasses, clovers, or other plants. In this country we are fortunate in having the choice of the best grasses, as well as climatic conditions favourable to the cultivation of good lawn turf.

GENERAL CONSIDERATIONS

Broadly speaking, the principal factors that determine the nature and extent of the preliminary work in the formation of a lawn are the character of the soil, the aspect of the ground, and the rainfall of the district.

From the point of view of turf formation, the *texture* of the soil is important. Any reasonably fertile soil which is fairly light and porous is excellent for the purpose, especially if the subsoil be a little more holding than the top soil. Conversely, a good loam or medium soil answers well over a porous foundation. Heavy soils are less satisfactory, as it is difficult to prepare the ground for sowing and to maintain a well-drained condition when the grass is established, but there are means by which these disadvantages may be minimised.

With regard to aspect, the majority of grasses thrive best in an open situation, and as far as it is advisable from an architectural point of view the margins of a new lawn should be cleared of overhanging trees. In some cases, however, it may be desired to construct a lawn in a sheltered spot, and use must then be made of those grasses which best endure the shade of trees. Still, the fact remains that under trees it is more or less difficult to establish and maintain a good lawn.

Adequate moisture is also an important factor in the upkeep of a lawn. In districts which receive a generous rainfall the question of an artificial supply of water scarcely arises, but in most other situations it is desirable to lay on water in order to save the turf in dry weather.

TURF

For turfing it is claimed that a lawn may be ready for use in rather less time than when seed is sown. Very rarely, however, is it possible to buy at a reasonable price turf that is at all suitable for the purpose, and even if it be available there is the cost of cutting, carting and laying to be taken into account. A great deal of

LAWNS

the turf offered for sale is cut from meadows and consists of strong-growing grasses and clovers entirely useless for the formation of a good lawn. Usually it contains a large number of weeds which grow with increased vigour when transferred to well-prepared soil.

Yet, occasions do arise when a lawn must be turfed. It should be clearly understood, however, that turfing is skilled work and must be placed in experienced hands. The best type of inland turf for general use is that from downland or old parklands, but it is difficult to procure.

SEEDS

It is now almost invariably the practice to make new lawns by sowing seed. Where the work of construction is sound, and suitable seeds are sown at a favourable time, lawns from seed materialise almost as quickly as those which are turfed, and the sward produced from good seeds is immeasurably superior. The spring and autumn seasons are both available for seed-sowing, and under certain conditions it is even safe to sow during summer. On the other hand, autumn and winter is the only reliable period during which to lay turf.

Long and careful research and numerous experiments have made it possible to establish by means of seeds areas of beautiful turf which are in every way comparable with the old natural lawns for which this country is noted. Prescriptions of grasses can be arranged to suit any situation, including the most difficult of soils, and new species have been brought into commerce as a result of much labour and patience on the part of seed experts.

Seeds of the various fine grasses are carefully harvested to ensure the highest degree of purity. On delivery at our warehouses each consignment is passed through machines specially designed to remove light or worthless seeds, dust, and extraneous substances of all kinds. The percentage of vitality is then determined with exactness by severe and reliable tests. We do not allow any prescription to be prepared until we are satisfied as to the purity and germination of each variety.

CHAPTER TWO

SOIL

SANDY SOILS

EXCELLENT TURF for lawns can be grown on sandy soil, provided the latter is not too open in texture and contains a proportion of clay. If the percentage is low, the soil is unretentive of moisture and fertilising material. This difficulty can be overcome to some extent by forking in well-rotted manure, peat, or leaf-mould. An excellent plan is to grow early potatoes, assuming the ground will be heavily manured. The residue of the manure will be most valuable for the future lawn.

Soil which is nearly all sand presents the greatest difficulty. Even with the aid of manure or other organic substances it is practically impossible to establish good turf, and only by importing a considerable quantity of fertile top soil can complete success be hoped for.

HEATHLAND (SANDY OR SILTY PEAT)

Lawns of the highest grade can be produced and maintained on sandy heathlands, if due attention be given to details. From the very nature of the soil, however, it is obvious that the turf will need regular top-dressing and copious watering in dry weather.

It is well known that heathlands are particularly subject to the formation of a hard layer a foot or more below the surface. These layers are generally composed of soil cemented by iron compounds, and the absence of lime seems to be one of the main factors governing their formation. Such a pan forms an effective barrier to drainage, and if encountered anywhere near the surface it must be broken up. Should the depth of the pan be such that it cannot be reached by digging, the only alternative is to lay in drains.

Heathlands are always deficient in lime, a dressing of which may be advisable in cases where the soil contains harmful compounds. It is necessary to dig in plenty of farmyard manure, while a dressing of appropriate artificials is also an essential prelude to sowing grass seeds.

Perhaps one of the most important matters in forming a new lawn on heathland is the selection of suitable seeds. Very few grasses do well under the somewhat exacting conditions prevailing, and failure to sow a mixture of the right varieties can only end in disappointment.

LOAM SOILS

Where the soil is loamy, and therefore of a nice intermediate texture, there should be little trouble in establishing a first-class lawn. Drainage is usually satisfactory, while there is sufficient organic matter present to assist the turf during spells of drought.

TRINITY COLLEGE, OXFORD.



Probably the only difficult type of loam is that in which the sand present is of very fine texture. The soil is then apt to become sticky in wet weather, and when dry the surface is somewhat hard. Dressings of gritty sand and the incorporation of rotted manure will, as a rule, effect a beneficial change in the texture of such soil.

CLAY SOILS

Clay soils are the most unfavourable of any upon which to maintain a lawn in good condition. One of the chief difficulties is to keep the turf in proper order during wet weather, especially when required for games. Usually there is insufficient surface drainage, and much trouble arises from worms and weeds. During rainy periods the turf becomes slippery, while in times of drought the ground shrinks to such an extent that cracks appear. Nevertheless, many instances arise when a lawn must be formed on clay soil, and much can be done to overcome the disadvantages. The most essential point is to ensure thorough drainage. If this can be achieved, and the surface covered with a few inches of lighter top soil, there should be no serious difficulty in obtaining good turf. Material improvement of clay soil can also be brought about by incorporating sharp sand or other gritty substances, as well as by the eradication of earthworms.

CHALK SOILS

Many of these are well adapted for lawns as drainage is good, and notwithstanding the thin character of the soil a sward of fine grass can generally be established without undue trouble. Many famous gallops and training grounds for thoroughbred horses are found on the various chalk downs.

The chief requirement is an adequate depth of top soil, and where this is deficient it should be supplied. A depth of 6 inches should be considered the minimum, while 9 inches is safer. Many chalk formations are capped with clay, and the soil has a tendency to slipperiness when wet and to cake on drying. The decay of organic matter is rapid, and on this account chalky soil resembles sand in being deficient in plant-food, although it is less affected by drought.

The addition of sharp sand is sometimes beneficial on chalk soil, and in many cases the use of organic manure is of the utmost consequence.



LEVELLING A LAWN.

- A. Site before levelling.
- B. Incorrect method of levelling.
- C. Correct method.



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LEVELLING OPERATIONS FOR TENNIS COURTS.

CHAPTER FOUR

PREPARATORY WORK

FOR SUCH outdoor pastimes as bowls, tennis or croquet a perfect level is generally required. In other cases the charm of a garden is not always enhanced by making the lawn too formal in outline. The trend of the ground and the view from the residence must have due consideration. It may not even be desirable to attempt a level, but before making steep slopes it should be borne in mind that soil facing south is liable to burn in summer, and the copious use of water may not prevent the turf from turning brown during continued dry weather.

Where no important alteration of the ground is contemplated, digging or ploughing to a depth of about 6 inches will suffice, but a more involved process is necessary when ground has to be levelled.

LEVELLING

At the outset we would draw particular attention to the error frequently committed of removing fertile top soil from the higher ground to make up the lower level. The poor subsoil, where exposed, has then to serve for the seed-bed, and in such circumstances it is impossible to create a good lawn. At least 6 inches of suitable top soil must be provided, and this should be increased to 9 or 12 inches over gravel or chalk. Where a level has to be formed, therefore, all the fertile top soil must be removed and placed on one side, after which the subsoil may be distributed as required. Should there be a considerable mass of earth to build up, the soil must be put down in layers 3 or 4 inches thick and each layer consolidated by treading and rolling. It is a mistake to bury weed roots, turf or tree stumps in the foundation. They inevitably lead to constant slight sinkages, and tree roots in particular decompose and give rise to injurious fungoid growths.

A simple method of ensuring a true level on plots of limited dimensions is to drive wooden pegs into the soil at regular intervals. The height of the pegs can be regulated by means of a straight-edge and a spirit level. In the case of a large area, the use of an engineer's level is essential.

TOP SOIL

When the subsoil has been formed into proper shape and details of drainage completed, attention can be given to top-soiling. If many stones are present, part of the top soil removed at the outset must be screened so as to provide a fine layer in which to sow the seed. The seed-bed can then be made up by spreading the soil in 3-inch layers, until the desired depth has been attained. It is important to tread each layer firmly, but no carting or other heavy traffic should be permitted over the ground once the top soil is in position.

IMPORTED SOIL

Where it is necessary to import top soil, the nearest approach to a fairly light loam should be chosen. The whole bulk should, if possible, be secured from one place so as to ensure uniform quality. In the event of there being more than one source, the different soils should be spread in layers, reserving the finer and more friable loam for the surface. To make up one part of the ground with rich loam and another part with light soil will result in turf of a patchy appearance, inasmuch as each soil fosters those grasses which possess an affinity for it.

Here it may be well to utter a word of warning with regard to the presence of weed seeds in imported soil. Every yard of fertile soil contains thousands of seeds of weeds. Many of the resultant plants may prove to be annuals and may not be difficult to deal with, but there is always the possibility of introducing extremely harmful weeds in imported soil. As far as possible, soil procured for a new lawn should be chosen from a site which is known to be reasonably clean and, if practicable, time should be allowed for the weed seeds to germinate, and the plants to be destroyed before grass seeds are sown.

MANURING

It is often assumed that grass will grow well on any kind of soil, even when in an impoverished state. This, however, is not the case, for without sufficient fertility it is impossible to maintain a plant in healthy growing condition. When once the grass is established, the soil can only be enriched under disadvantages to which no other crop is subject, and the only way of fertilising it is by top-dressing. Consequently, there are excellent reasons for putting the land into good condition before sowing seeds or laying turf.

Well-rotted farmyard manure is always valuable in preparing ground for a new lawn. It provides organic elements of plant-food, and furnishes a gradually available supply of humus which improves the structure of the soil.

Cow or pig manure answers well on light sandy soil, and peat-moss litter is also quite good. For heavy soil short stable manure should be used. The material in each case must be as old as possible, and should be lightly forked into the ground at the rate of at least 1 cubic yard to every 100 square yards. For large areas 30 tons and upwards per acre may be ploughed in. Fresh manure should be avoided at all costs, not only on account of its tendency to make the soil hollow, but for the reason that it invariably contains a large number of fertile seeds of weeds and coarse grasses.

The only alternative to natural manure, now so difficult to obtain, is the use of artificials favourable to the healthy growth of grass. A combination of nitrogen, phosphates and potash must be provided, as the finer grasses such as are used for lawn turf are only able to hold the ground when adequately furnished with these elements.

PREPARATORY WORK

The simplest method of fertilising the ground is by the use of our Lawn Fertiliser which is specially adapted for promoting the growth of fine grasses suitable for tennis courts, garden lawns, bowling greens, etc. This artificial merely requires to be evenly spread and lightly raked in a few days before sowing. For top-dressing newly laid turf this Fertiliser is equally effective.

It is sometimes recommended that either bone meal, superphosphate, sulphate of ammonia or other artificials be used alone to enrich the soil before sowing grass seeds. No one of these supplies all the requirements of the turf, and the benefit resulting from their use must depend upon the type of land to be dealt with. There are cases in which an incomplete fertiliser may be sufficient, because the young grass is able to furnish itself with the missing ingredient from the soil.

LIME

The application of lime is not always necessary in the preparation of a new lawn, as many grasses thrive equally as well when there is no lime in the soil as when lime is present. There are, however, cases where a dressing of lime prior to sowing is useful. Soils of a peaty nature are included in this class, and some very sandy soils also are extremely acid through the presence of an excess of iron salts. In such circumstances, a dressing of carbonate of lime at the rate of 4 ounces per square yard should be raked in during the preparation of the ground. Without such a dressing it might be difficult to establish a good plant of grass on the classes of soil in question; the quantity recommended does not produce a marked alkaline effect.

EARTHWORMS

Earthworms are a source of trouble in the formation of lawns, and by throwing up casts they loosen the soil in small patches. Where turf has been newly laid, worms quickly force a way to the surface during the first spell of damp weather and spoil the level.

On bowling greens, tennis courts and croquet lawns worm casts are particularly objectionable, and when worm-infested ground intended for games is being prepared the entire area should be cleared of worms before seed is sown or turf laid. This may easily be effected by using one of the worm killers we supply for the purpose.

SURFACE DRAINAGE

Heavy soils may be improved by the addition of fairly coarse sand. Dressings of the sand should be spread over the ground at the rate of about 1 cubic yard for every 50 square yards and raked in during the preparation of the seed-bed. It is quite safe to use ordinary pit sand provided it is sharp, i.e., not liable to cake;



indeed, such sand is preferable to sea sand where it is undesirable to introduce a heavy proportion of lime.

A convenient and effective method of surface draining is to dig the soil over once or twice, incorporating on each occasion a fairly thick layer of coke breeze. Then rake in dressings of sand as already advised.

CLEANING THE GROUND

It is of the greatest importance to clean the ground thoroughly before sowing. Fine grasses are unable to compete with weeds, as they germinate and develop far more slowly. On the other hand, weeds, by their rapid growth and more extensive root system, are able to take possession of the soil and rob the immature grasses of light, air and moisture. A sowing of grass seeds on very weedy land may lead to failure, hence there are good reasons for cleaning the ground beforehand.

It is not too much to say that the cause of complaints which are sometimes made of the alleged impurity of grass seeds is almost invariably attributable to weed seeds that were brought to the surface by digging, or introduced through the medium of imported soil or stable manure. Many such weeds spring from seeds which, from their size, form and colour, could not possibly be included in a prescription of grasses without arresting attention. All soils contain numerous indigenous weed seeds which are continually spread about by the agencies of nature. Those who are practically acquainted with gardening know that land which has been regularly cultivated for years, and is supposed to be quite clean, always produces a plentiful crop of weeds, even though no seeds whatever be sown.

As the most practical and convenient method of cleaning the seed-bed, we recommend that the ground be prepared in spring or early summer and allowed to lie fallow until August or September. Under such management most of the weeds present spring up during the interval, and can be destroyed by raking and hoeing. As an exception, retentive soils that are difficult to prepare in spring can be put into order during the autumn, the surface being so far prepared that only a few turns of the rake and roller are needful in spring; by this method, in the majority of seasons, many weeds can be destroyed and grass seeds sown before the spring is far advanced.

At one time, soil burning was largely practised as a means of destroying weeds, but it is now very rarely adopted. Steam sterilisation is successful as a means of destroying weed seeds, vermin and harmful organisms without much loss of fertilising material. It is, however, somewhat expensive to employ on a large scale owing to the nature of the apparatus.

Although a thorough cleaning of the ground is not so material before turfing as when seeds are sown, many turfed lawns have been disfigured by dandelions, docks and other large weeds which have forced a way through the turf from scraps of root left in the underlying soil.

FINAL PREPARATION

During the weeks immediately prior to sowing seeds or laying turf, advantage must be taken of every favourable opportunity to create a firm and friable surface by the diligent use of rake and roller. It is insufficient to go over the ground once with each implement. To ensure proper conditions for the germination of the seed and the development of the grass, the surface must be broken up very finely and all large stones removed. The seed-bed must also be made perfectly firm; this is necessary to safeguard against depressions, as well as for the reason that grass seedlings cannot become properly established in a loose soil.

Where the area is not too great, the seed-bed should be well trodden in order to make sure there are no hollow spots. Then rake and roll a number of times until the ground is firm, but with a slight resilience. If possible, again test the level and make good any hollows or remove prominences. Such finishing touches, when carried out with patience and by a skilful hand, will leave the surface almost as true as a billiard table.

CHAPTER FIVE

SOWING

QUANTITY OF SEED

FOR A NEW LAWN it is advisable to sow 2 ounces of seed per square yard, or about 5 cwt. per acre, to ensure a close turf in the shortest possible period. A thick sowing greatly contributes to success by rapidly covering the ground with grass, thus helping to suppress indigenous weeds. Where time is not of the greatest importance, however, a seeding of 1 or 1½ ounces per square yard should eventually produce a sound turf.

The tennis court affords a good example of the quantity of seed required for a lawn plot. The dimensions of the court itself are 78 feet by 36 feet and for tournament play a margin of 21 feet is provided beyond each base line, with 12 feet at each side, making a total of 120 feet by 60 feet, for which 100 lb. of seed is necessary to sow at the rate of 2 ounces per square yard. In many gardens a lawn of this extent cannot be secured and players have to be content with an area of about 108 feet by 54 feet. For such a piece of ground up to 84 lb. of seed should be provided.

From a thick sowing it is a common achievement to have a lawn ready for use in the early summer following an autumn seeding. Results depend, however, so much on the weather and other circumstances beyond control that it is impossible definitely to state the time that must be allowed before the turf is ready.

SOWING TIMES

Grass seeds may be sown in spring or late summer.

Spring sowing generally answers well, but in some seasons there is a possibility of the young grass being damaged by drought unless a supply of water is available. The proper time depends on the district and the season. From the middle of March to the end of April is the best period in the south and midlands, but farther north the sowing season is a week or two later. If, however, the ground cannot be prepared well in advance, or there is reason to believe that the soil is weedy, sowing should be deferred until the following September.

Between the third week of August and mid-September conditions are usually very suitable for sowing grass seeds. As a rule, there is sufficient moisture to ensure quick germination, and the warm soil promotes rapid development of the grass. A good plant is sometimes obtained from seeds got in during October, or even as late as the beginning of November, but such sowings are not generally to be recommended, although circumstances may arise which justify the risk.

METHODS OF SOWING

The sowing may be done by hand, or by means of a machine. Whichever method is preferred, more even distribution will be obtained by dividing the seed into two equal portions and sowing by two operations—the second across the first at right-angles. This plan is open to extension, if desired, by lining up the ground into equal spaces and dividing the seed into double the number of equal quantities. As seeds of the finer grasses are both small and light a calm day must be chosen for sowing.

For large areas a seed barrow or 'fiddle' sower may be used with advantage, but even with these implements two sowings are preferable to one. The machine should be kept at an even pace, sowing one half of the seed moving up and down the ground and the remainder across the ground.

When the seed has been sown it should be covered lightly with soil by raking or harrowing, but care must be taken not to bury it deeply or germination will be irregular. In order to cover any seed remaining visible after raking, it is worth some trouble to spread a very thin dressing of soil over the surface. In most gardens where greenhouse plants are grown to any extent there is an accumulated heap of mould which has been knocked out of pots. This is excellent material for the purpose; it is generally of the right texture, fairly free from weed seeds and only needs to be passed through a fine sieve. On heavy land a thin covering of clean sharp sand is better than soil, and is some protection against birds.

The final operation is the rolling of the ground in two directions. This should not be omitted unless the soil at sowing time is damp. Under favourable conditions germination takes place in ten to fifteen days, and should the soil remain damp during this period rolling must be deferred until the grass is fairly well established and ready for the first cutting. But the soil may dry off within a day or two of sowing, and a rolling can then be given.

BIRD SCARES

By some means birds should be scared away until the seed has germinated. Small plots can be protected by nets. Black thread is also very effective; the strands need not be very close together, but they must be black. On a large area, however, these methods are out of the question; but one mode of defence, both simple and cheap, is to tie strips of tin, rag or feathers on lengths of twine connected to stakes.

We do not advocate treating grass seeds with any liquid preparation to render them distasteful to birds, as experiments have shown that substances sometimes used for the purpose are detrimental to germination. A dusting of red lead, however, does not harm the seeds, and may give them some protection from birds.

SELECTION OF SEEDS

THE CHARACTER of turf produced from seed is determined by the varieties of grasses used and the proportion of each sown. Many grasses which are valuable for the fodder they yield in meadows and pastures are entirely unsuitable for the formation of a close carpet of grass. It is therefore of the highest importance to use the proper varieties, in the correct proportions, having regard to the nature of the soil and the purpose for which the turf is required.

It must be borne in mind that every lawn grass has a decided preference for certain conditions of soil, situation and water supply. Another matter to be considered is the habit of growth, some grasses possessing a strongly creeping root system while others are more or less tufted in character.

Seed Mixtures. For many years past we have specialised in prescribing mixtures of grass seeds for lawn and other turf areas. Each of these prescriptions is excellent for its particular purpose, and in the purity and high germination of the seeds. In order that we may be in the best possible position to supply the most appropriate combination of varieties for any given purpose, details should be sent us of the character of the soil and any other feature having a bearing on the case. Particulars of our mixtures may be obtained on application, and we are at all times happy to assist clients in any way.

The importance of sowing the correct combination of grasses in any given instance cannot be over-estimated. Further, it is not always realised how small a percentage of coarse grass or weed seed in a mixture of fine grasses is sufficient to produce a considerable infestation of unsightly herbage; such results only lead to disappointment and increased expenditure.

The following grasses are suitable for lawns and other forms of pleasure turf, being naturally adapted to the soil and quality of turf indicated.

Red Fescue (*Festuca rubra*). This grass possesses many desirable qualities which are of special value in a lawn. The foliage is very fine, close-growing, stands hard wear, and the plant is not exacting as to habitat. It thrives on practically all soils, from sand to fairly heavy loam.

Several varieties of Red Fescue are known. The one most commonly employed for lawns is *Festuca rubra fallax* (Chewing's Fescue). Seed of suitable strains of Creeping Red Fescue (*F. rubra genuina*) is scarce and at present high in price, but it can generally be included in lawn prescriptions at a slightly increased cost. In habit it is extensively creeping. A useful indigenous type of Red Fescue is that collected from sea marshes (*F. rubra genuina*, var. *glaucescens*) and this should if possible be sown, in conjunction with other fine varieties, when it is desired to reproduce 'Cumberland' or 'Sea-washed' turf from seed.



SELECTION OF SEEDS

Sheep's Fescue (*Festuca ovina*) has a partiality for chalk downs, and it also occurs to a considerable extent in the Scottish Highlands. This grass has fine foliage and penetrating roots which enable it to withstand drought. It is a useful variety for first-class lawns, but genuine seed is difficult to obtain.

Fine-leaved Fescue (*Festuca capillata*) grows in smaller and more compact tufts than Sheep's Fescue and has shorter and even finer leaves. Although unable alone to form smooth turf on account of its singularly tufted habit, this grass proves of considerable value as a constituent of fine lawns where the soil is exceptionally poor and stony. As in the case of the preceding variety, however, genuine seed of Fine-leaved Fescue is expensive, and this rather limits its use.

Hard Fescue (*Festuca longifolia*) is valuable for its fine foliage and property of withstanding constant wear. Being distinctly tufted in habit, Hard Fescue cannot be used alone, but mingled in due proportion with other sorts it contributes largely to the formation of a fine durable turf. It is rather more tolerant of cold and drought than many other grasses.

Creeping Bent (*Agrostis stolonifera compacta*). The main feature of this *Agrostis* is a habit of creeping along the surface of the ground, and in certain strains the runners develop to such an extent that one plant may cover several square feet. It may be regarded as a general principle that those kinds in which the creeping habit is highly developed need a great deal of attention as regards top-dressing and watering. The surface must be continually dressed with soil to embed the runners, when they will take root and form new herbage. The resultant turf is thick and uniform, but there is always a peculiar grain due to the network of surface runners. In dry weather the grass must be copiously watered or it degenerates into a mass of hard brown stems.

English Bent (*Agrostis* sp.). A fine-leaved *Agrostis* of intermediate creeping habit. It is quite distinct from the ordinary *Agrostis vulgaris* or *tenuis* and there is little true seed in commerce.

Common Bent, Browntop, or New Zealand Bent (*Agrostis vulgaris* = *A. tenuis*). This grass is somewhat tufted in habit but spreads slowly from short runners and forms a hard-wearing turf.

Brown Bent, or Velvet Bent (*Agrostis canina*) forms beautifully fine turf of excellent colour, but it must be adequately watered in dry weather. When pure and reliable seed is available, it should have a useful future as a lawn grass.

Fiorin, or Redtop (*Agrostis alba* = *A. stolonifera major*). On account of its seed being plentiful and cheap this grass is sometimes offered as a Creeping Bent for lawns, but its spreading power is decidedly limited. Moreover, Fiorin is quite unsuitable for a fine lawn owing to its comparatively strong-growing habit, but it is useful for sowing where turf is needed that will stand rough usage.

LAWNS

Smooth-stalked Meadow Grass (*Poa pratensis*) grows extensively on light well-drained soil. The roots are shallow but the plant has the advantage of a creeping habit. It does not develop well in the first season but subsequently makes a useful turf, producing fresh foliage with astonishing rapidity after drought.

Rough-stalked Meadow Grass (*Poa trivialis*) is adapted for moist situations and has the merit of flourishing under trees or in shady spots.

Wood Meadow Grass (*Poa nemoralis*) shares with Rough-stalked Meadow Grass a partiality for shady situations, and is therefore useful for lawns which do not enjoy much sunshine. The foliage is particularly fine and green, and it is a valuable grass for sowing under trees where turf of fine texture is wanted.

Crested Dogtail (*Cynosurus cristatus*). This grass will stand a great deal of hard wear and is a valuable component of turf for cricket pitches and recreation grounds. It cannot be recommended for first-class lawns, as the leaf blades are somewhat wide and contrast with the finer grasses, but where the texture of the turf is not of first importance Crested Dogtail is a useful variety for sowing on chalk soils and compact loams.

Perennial Rye Grass (*Lolium perenne*). On loam or clay soils Perennial Rye Grass is used on a considerable scale in the rapid production of sports turf, for which purpose it is a valuable grass in combination with other sorts. When sown alone it does not give satisfaction, being unable to tiller out and form bottom herbage.

Many old lawns contain a large proportion of Perennial Rye Grass. Now, however, it is very much less common to sow it on lawns, the demand being for turf of a finer character than can be obtained with this grass. We strongly advise the use of lawn mixtures which exclude Rye Grass, unless there is special urgency and turf of a comparatively strong-growing habit is not objected to. When, as sometimes happens, a sward has to be formed within a few weeks, Perennial Rye Grass is deserving of attention.

A point of importance in using Perennial Rye Grass is that the sowing must be sufficient to produce a dense plant. The turf needs careful attention from its first appearance and should be mown frequently during the entire growing season, otherwise lateral stems and bents are produced which defy the action of the mowing machine. Another matter to consider is that, although a temporary advantage may be procured by sowing Rye Grass in a mixture, rapidity of growth is likely to be less pleasing when the turf is established, owing to the amount of mowing required.

For many years we have carried out extensive experiments with Wild, Indigenous or Leafy strains of Perennial Rye Grass for use in turf mixtures, and we advocate the use of these in preference to ordinary strains whenever possible.

SELECTION OF SEEDS

The question of including Perennial Rye Grass in lawn mixtures must always be a matter of individual choice, and a clear indication as to whether or not it is wanted should be given when grass seeds are being purchased.

Clovers. Whether clover should be sown on a new lawn depends on circumstances. As a rule it is undesirable, but in extreme cases its presence is advantageous. On very poor light land in districts liable to drought, it is more difficult to establish a lawn when clovers are not used.

Turf intended for bowls, tennis or croquet should be composed entirely of grasses. Clovers make the turf slippery, while after a shower they hold moisture longer than grasses. A further objection is that they do not stand hard wear so well as grasses. Where, in other cases, the presence of clover is desired, the following sorts may be used; but we never include them in a lawn mixture unless specially requested to do so.

Wild White Clover (*Trifolium repens*). The dwarf habit and dense foliage of this clover make it the most suitable variety for lawns on thin dry soils. Seed, however, is high in price, and for this reason the ordinary cultivated White Dutch Clover is often recommended in its place. The latter has stronger foliage and is not a very long-lived plant. We are not altogether in favour of the substitution, but the fact remains that it must sometimes be adopted owing to cost.

Yellow Suckling Clover (*Trifolium dubium*). This variety thrives on poor gravelly soil and forms a dense mat of fine foliage. It is a quick-growing plant, showing abundantly in the height of summer. Suckling Clover is an annual, but seeds itself down every year even under close mowing.

Birdsfoot Trefoil (*Lotus corniculatus*). A perennial plant which is sometimes very useful for light dry soils, where it generally assumes a dwarf habit.

Yarrow (*Achillea millefolium*) is a creeping perennial and multiplies rapidly by root growth. On dry gravel or chalk soils it is sometimes useful, especially for turf which has to undergo hard wear. The herbage will bear constant traffic and remain green long after the grass has lost its attractive appearance. Whenever Yarrow is present, however, the turf must be kept regularly mown or the foliage becomes coarse and unsightly. So great is its power to thrive under heat, that Yarrow occasionally becomes a great nuisance in dry summers and can be kept down only by constant attention.



ANNUAL WEEDS IN GRASS.

Upper illustration: A plot of spring-sown grass in which indigenous annual weeds such as Groundsel and Goosefoot had appeared.

Lower illustration: The same lawn a few months later. No hand-weeding had been carried out, but the weeds disappeared under the mowing machine.



CHAPTER SEVEN

THE TREATMENT OF YOUNG GRASS

WORM CASTS

IN A SHORT TIME after sowing, trouble occasionally arises from worm casts. It is comparatively unimportant when the casts are few and far between, but sometimes scores of them may be seen on a few yards of ground. When and how they should be dealt with is often a source of perplexity, but when the casts dry a light switching with a bamboo cane will break them up.

WATERING

As a rule, the watering of newly sown lawns is to be avoided. Severe drought, however, may follow a spring sowing, and then water must be given. A small plot can easily be watered by hose and sprinkler, or even with a watering can having a fine rose. A large area presents greater difficulty, especially in the absence of hose or if water has to be carried a long distance. In any case, there must be no rough trampling on the soil, and flat boards laid at intervals will prevent most of the injury from traffic. The water must be delivered in a fine spray and for a sufficient time to soak the ground to a depth of several inches. A mere sprinkling on the surface is useless; in fact, it may be harmful.

FERTILISING

When the grass is about an inch high, protection can be afforded by means of a light dressing of malt culms or kiln dust. This material serves to shield the tender plant from hot sun or sharp frost, and also acts as a gentle stimulant. It should be applied at the rate of about 4 ounces per square yard, or 10 cwt. per acre. Generally speaking, no other fertilising treatment should be given until the grass is at least six months old, and full dressings are not recommended before the lapse of twelve months from sowing.

ROLLING

It is advisable to roll a new lawn a day or two before the first cutting, but only when the ground is dry. The implement must be drawn rather slowly over the surface and the operation needs some care. For small lawns a wooden roller, or a hollow iron roller weighing about 2 cwt., is all that is desirable at first, but after several cuttings a heavier implement may be brought into use on light to medium soils.

MOWING

The first cutting should take place when the plant is 2 to 4 inches high, and may be done with a light mowing machine which has been carefully adjusted to make a clean cut without tearing up the plant. A machine without a front roller is, of course, particularly suitable for the early mowings, and the knives should be set high.

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Subsequently, the mower may be used as often as necessary, but the turf should never be closely shaved during the first summer.

WEEDS

Weeds are bound to be in evidence in the early life of a lawn. The seeds are present in such large numbers in all fertile soil that it is impracticable to eradicate them totally before sowing. But many of the weeds which spring up in newly sown turf are annuals, and although they may retard the growth of the grass to some extent their presence is of short duration. On a well-prepared bed which has lain fallow for a few weeks before sowing, trouble with annual weeds should not be serious; but when they are so numerous that the grass is almost overpowered the only way to save the turf is to keep the weeds constantly cut down by scything or mowing. Plantains, Dandelions and other perennials may be removed by hand while quite small. With a little care they can be drawn with the right hand between the fingers of the left hand placed flat on the ground, without uprooting the surrounding grass. Young grass will not, of course, bear much traffic, and therefore weeding should be done from planks laid on the ground and moved across the surface as each strip is dealt with.

A special watch should be kept for the appearance of coarse grasses. They are indigenous on many soils, and perhaps the commonest is Yorkshire Fog (*Holcus lanatus*). The presence of this objectionable variety can at once be detected by its broad pale green hairy leaves. While young, the plants can easily be removed, but when Yorkshire Fog has secured a firm hold the only remedy is cutting out. If left, every patch will increase in size from year to year.

SURFACE DEPRESSIONS

Newly sown ground, especially when hastily prepared, sometimes shows depressions after the grass is visible. Where these depressions are shallow an occasional sifting of fine soil may follow each mowing, so that with patient attention a true surface can be restored; but large quantities of soil, roughly thrown down, will smother the young plant.

With deep hollows a different procedure must be adopted. Young grass cannot be cut and rolled back in the manner usual with an established turf, and if deep hollows are filled with a thick covering of earth it is necessary to resow. To avoid this trouble it may be possible to cut the young turf in small sections, lifting each one separately with the aid of a spade. After making good the level, the pieces of turf can usually be relaid without much injury.

TIME REQUIRED FOR DEVELOPMENT

This depends on the period of the year, the quantity of seed sown, the weather which follows the sowing, and the attention given to the grass. An August or early September sowing should, under favourable circumstances, produce a good turf early the following summer. Spring sowings are dependent on variations of temperature and other peculiarities of the season; but when the weather is good

THE TREATMENT OF YOUNG GRASS

and the plot receives due attention, a sward is often sufficiently developed for use towards the end of July or early in August. In all cases where turf is wanted quickly an extra thick seeding is desirable.

POSSIBLE CAUSES OF FAILURE

Causes quite beyond control occasionally render it necessary to resow. On very dry soils a spring seeding may be ruined when a period of drought follows, in which event the ground should be kept clean until the approach of autumn. If fresh seed be sown at the end of August or early in September, rain and dew will generally ensure rapid development of the young plant which should become well established before winter sets in. Dry sandy loams, on which it is difficult to obtain a plant in spring, may usually be sown with complete success in the early autumn.

Should a warm and excessively wet period follow sowing, the young grass may become affected by damping-off fungus (*Pythium*), when the seedlings turn red and rot off at the ground line. Often the damage done is not great, but on occasion the fungus spreads through the entire plot, with the result that partial resowing is necessary. The best method of checking the disease is described on page 49.

CHAPTER EIGHT

LAYING TURF

TURF may be laid at any time from the end of September to early March, but whenever possible preference should be given to autumn or early winter, so that the grass may have ample time to become established before the following summer. When laid in late spring, the sections are liable to separate under a hot sun or drying wind, and the whole surface becomes disfigured by ugly seams which have to be filled with soil and sown with grass seeds.

The principles governing the preparation of the ground for turving are the same as for a sown lawn, i.e., the soil must be made perfectly firm with a shallow surface tilth. Before the turf is placed in position, the ground should be given a dressing of our Lawn Fertiliser to encourage root growth and enable the turf to become re-established within the shortest possible time.

To simplify the work of laying, each piece of turf should be brought to a uniform thickness by inverting it in a specially made three-sided box and cutting off the surplus soil by running a large knife across the top. It is wise also to examine each piece with a view to removing the weeds from which turf is rarely free.

Turf should be laid in rows with alternate intervals, after the fashion of brick-work. Each piece must be firmly pressed into position, and a heap of sifted soil should be at hand for making good irregularities in the surface as the turf is laid. The beating of turf into position with a wooden beater is sometimes advocated, but this operation is easily overdone. Provided each piece is pressed firmly against its neighbour as the work proceeds, the beater may practically be dispensed with.

As soon as the laying is completed, a dressing of fine soil should be spread over the entire area and brushed into any crevices which are visible, and wherever the plant is thin grass seeds must be sown. The final operation consists of a double rolling—the second to cross the first at right-angles.

Newly laid turf should be left untouched for three or four weeks, in order to give the roots time to become established in the underlying soil. Light rolling may then be done at intervals during suitable weather, but a heavy roller should not be brought into use until late spring. A dressing of our Lawn Fertiliser in March or April will be found extremely valuable in the case of lawns laid during the previous winter, especially if the grass is not making satisfactory progress.

CHAPTER NINE

GENERAL UPKEEP

THE ART of turf cultivation may be said to consist of mowing, rolling, watering and top-dressing, and the secret of success is the skilful performance of such operations at the correct times, as dictated by the season.

MOWING

Lawn grasses should never be allowed to grow to any great length, and a fairly safe rule is to cut whenever there is any grass to remove. In winter the growth varies greatly according to the weather, and mowing may not be necessary for several weeks. For the first cutting in February or March, set the knives of the machine high, and keep them up while the weather continues cold and windy. During April the knives may be gradually lowered, and in this month mowing must be carefully and regularly carried out. Any neglect at this time may result in a plentiful crop of hard stems which the machine will not take.

As the season advances the need for more frequent cutting will be evident, until in warm moist weather mowing twice a week, and possibly every alternate day for a brief period, may not be too much. No hard and fast rules can be laid down on this point. With the approach of autumn, less mowing is needed, and on many lawns it is discontinued altogether when the grass becomes winter dormant. The date depends on the district and the character of the season, and may be any time between mid-October and mid-November.

The sole plate of the mower should never be close enough to the ground to injure the turf. Rather than cut twice a week with the blade scraping the ground, it is better to mow more frequently at a moderate cut. In very dry weather it is specially important to avoid close cutting. To maintain an even sward, the direction of the mowing must be varied each time, so that the turf does not develop a 'grain.'

On every occasion the machine is used it is advisable to make sure that the cutters are properly set. An appreciable space between the upper and lower blades will result in the grass being torn out; on the other hand, if the knives press on the bottom blade the machine will work stiffly and cut in ribs. The secret of successful mowing lies in the knives just touching the blade along its entire length, and to this end it may be necessary to make small adjustments at fairly frequent intervals.

The use of the grass box is a largely discussed question. There is no doubt that turf derives some benefit from the grass cuttings left on a lawn and they are a protection against the heat of the sun. On the other hand, there are several objections to this practice which increases labour and disseminates weeds. Moreover, the presence of cut grass on a tennis court or croquet lawn renders play slow, and on a bowling green it would not be tolerated. As a rule, therefore, the box should be attached for cutting all turf that is used for such games. In

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cases where the box is not used, lawns must be frequently mown to prevent the cuttings from becoming coarse.

ROLLING

In most matters relating to the rolling of turf the nature of the soil is the governing factor. Light soil requires regular rolling in order to create a firm surface, but where the land is at all heavy rolling should be practised with the greatest possible care, as the injudicious use of a heavy implement may cause serious injury. As a general rule, the best results are obtained by rolling when the surface is dry and the underlying soil remains sufficiently damp to ensure compression. If worm casts are present they must be broken up before rolling commences.

To counteract the effects of frost a roller of greater weight than is customary may be used in spring, but it is not desirable to employ such an implement more than once or twice, and the surface at the time must be quite dry.

Several points need to be considered when choosing a roller. The weight and pattern are determined mainly by the character of the soil and purpose for which the turf is intended, but some regard should also be paid to the person who has to move it. Further, it must be borne in mind that the pressure exerted is in inverse proportion to the length of the implement, and the diameter also has an influence.

For ordinary lawns on heavy soil a roller weighing from 1½ to 3 cwt. will suffice, and for light and sandy ground the implement may weigh from 3 to 6 cwt. Those having hollow double cylinders, with rounded outer edges, can be moved more easily than ballast rollers of similar weight and are preferable for most purposes.

Heavier rollers than those specified above may be employed for tennis courts in order to ensure a firm fast surface, but they should only be brought into use under favourable conditions. For bowling greens a special single-cylinder open-ended roller having a perfect periphery should be obtained and used for no other purpose.

We do not hold the opinion that rolling can be dispensed with altogether, but undoubtedly a large amount of turf is consistently over-rolled, especially in some cases where a heavy motor mowing machine is regularly used.

AERATION

Not only is the surface of turf liable to become hidebound, but the underlying soil also may be so consolidated that beneficial elements cannot penetrate: this is especially the case with areas used for games. It is therefore desirable that lawns should be deeply pricked from time to time. This process allows air and water to penetrate evenly and improves surface drainage; plant food is carried to a greater depth and deeper root formation is encouraged. These factors naturally increase drought resistance.

This aeration can be most conveniently effected by the use of a fork with either hollow or solid tines, or by one of the special machines made for the purpose. On most soils it should be sufficient if the operation is carried out with hollow tines once every couple of years, alternating with solid tining. A fork with solid

tines is sometimes very beneficial in cases where specially deep piercing is needed. The use of a solid tine machine may with advantage be repeated several times in the course of a year, when there is sufficient moisture in the soil.

DEPRESSIONS

Small depressions are liable to appear in lawns, and these lead to difficulty in mowing. In all such cases the surface should be made true in order to permit of the even passage of the mower.

The mere broadcasting of top-dressing material is not sufficient to correct depressions. A heap of sand or soil should be kept handy and a little worked in, after each mowing, just where it is seen to be needed. The spots requiring treatment are easily noticed by reason of the grass growing more prominently.

Where inequalities are more pronounced the following treatment should be adopted. Across the sunk spot cut with an edging iron parallel lines in the grass 10 or 12 inches apart, making also one cut across the centre at right-angles; then loosen the turf with a turving iron and roll it back from the centre without, however, cutting it away completely. Make the bed perfectly level, leaving the soil with a firm but crumbled surface. Carefully restore the turf which will be found rather too long for the space, and gently press it into position; beat down, give a soaking of water and in due time mow and roll. In a few days no trace of the operation will be visible, but the grass ought not to be played upon until it is firmly re-established.

WATERING

Wherever possible, a water supply should be laid on to a lawn. A certain expense may be involved, but we know of no single instance where it has been regretted, and in some years artificial watering is the only possible means of saving a lawn.

Where intensive fertilising treatment is practised, watering in dry weather is an absolute necessity, although it is wise usually to withhold water until there is real need. But when once watering has been commenced it should continue regularly until the drought breaks, and enough must be given at a time to soak the ground to a depth of 3 or 4 inches. A light sprinkling may be harmful, as it causes the roots of the grass to work towards the surface.

Sprinklers capable of delivering a mist-like spray are preferable to the hose pipe. With the latter the rush of water on a limited area is liable to wash soil away from the roots of the grass. Late afternoon or evening is the best period for watering, but when labour is not available at that time water has to be given during the day. It is supposed by many to be dangerous to use a sprinkler in the daytime, but experience has shown that no harm is done provided every effort is made to avoid the grass drying out under the heat of the sun.

Should no water be available there is, of course, very little to be done until the drought breaks. But if the turf has not been actually destroyed, its recovery may be greatly assisted by judicious fertilising. Lawns which have been heavily watered will also need help in this direction later on, as the continued use of water depletes the soil of much soluble plant-food.



CHAPTER TEN

TOP-DRESSING

THE REPEATED MOWING of a lawn makes a great demand on the resources of the soil. For at least six months of the year the mowing machine is regularly in operation and a surprising amount of grass is removed in a single season. Under this process the soil becomes impoverished and the turf deteriorates unless adequately and regularly top-dressed.

There are several signs which denote that turf is suffering from lack of plant-food. When the grass plant becomes thin, or poor in colour, or moss encroaches, it is a clear indication that the soil is becoming exhausted. The gradual multiplication of weeds is often another warning.

Top-dressings may be divided into two classes, according to whether the material used consists of sand, soil, farmyard manure and leaf-mould, or whether it is largely in the form of artificials. It may be accepted as a general principle that the former are effective mainly in improving the texture of the soil and preserving an even surface, whereas most of the necessary plant-foods have to be supplied by means of artificials.

Nitrogenous fertilisers have a powerful effect on grass and stimulate the development of leaves and stems to an extraordinary extent. Lawns therefore must have an adequate supply of nitrogen, but an excess is to be guarded against as it makes the turf susceptible to drought and cold, and encourages fungoid diseases. Phosphates promote root growth and increase the strength and wearing qualities of turf; if used alone they are apt to be followed by the development of clover, and it should be the rule in the case of lawns never to apply phosphatic manure unless it is to be supplemented with a nitrogenous dressing. Potash is the agent by which the turf is fortified against disease, but very little of this fertiliser is usually required for lawns, and only on chalk, gravel or peat is there likely to be serious deficiency.

HOW TO MANURE A LAWN

The simplest and most successful method of manuring a lawn is to give a complete dressing of artificials in spring: supplement these with small doses during summer, and apply a good organic dressing in the autumn. The main dressing should be rich in nitrogen and gradually available phosphates; there must also be a moderate percentage of soluble phosphates and a small amount of potash. It is desirable for the elements to be drawn from several sources, both organic and inorganic, in order that the fertiliser will gradually supply the needs of the grass over a considerable period. Nitrogen, more especially, must be present in several degrees of availability so that it is not lost after the first heavy rain. The Lawn Fertiliser we supply provides all these essentials, and in the majority

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of cases it will be found more economical and convenient than a mixture of raw artificials. Being in the form of dry powder, the Fertiliser is easy to handle; it may be used alone, but it will facilitate distribution if the artificial be mixed with two or three times its bulk of clean soil or sand.

A good Raw Guano (Peruvian if obtainable), containing a reasonable percentage of nitrogen, also makes an excellent dressing for turf, especially on light soil. It may be applied at the rate of about 1 ounce per square yard. Other organic manures occasionally used for lawns on sandy soil are Fish Meal and Meat Meal, both of which are rich in nitrogen. They are, however, low in potash, so that the separate addition of this element may be needful.

Sulphate of Ammonia. Light dressings of sulphate of ammonia are sometimes used as a stimulant to supplement the main application of a complete fertiliser. From a $\frac{1}{4}$ -ounce to $\frac{1}{2}$ -ounce per square yard may be used, mixed with sufficient sand to ensure even distribution. These small dressings are best given during showery periods.

Ash from burnt garden refuse, hedge trimmings, etc., is useful for lawns on light soil, although it is liable to encourage clover. A dressing may consist of 2 ounces per square yard, but the ash should be spread as soon as it is ready or much of the benefit will be lost.

Soot is often recommended as a dressing for turf, but its only fertilising value is the small amount of nitrogen present. Spring is the usual time for applying soot, but it must be distributed several weeks before the turf is required for play. Not more than 4 ounces per square yard should be used at a time, and the soot must be exposed to the weather for a few weeks before application. Fresh soot often contains injurious compounds.

Poultry Manure. This makes a useful top-dressing if it has been stacked with an equal amount of fine soil for about twelve months. Turn the heap occasionally, and before use pass the material through a fine sieve. Apply about 4 ounces per square yard.

Sulphate of Iron. Lawns are occasionally dressed with sulphate of iron, which is useful as a tonic. It strengthens the resistance of the grass against fungoid attacks and is used for combating such diseases. A combination of sulphate of iron and sulphate of ammonia will often prove effective in checking certain weeds, but it may be necessary to give several light dressings of the mixture before the weeds are finally disposed of.

Sharp Sand has no fertilising properties, but it can with marked advantage be applied to lawns on damp or heavy soil. Fairly heavy dressings up to an eighth of an inch in depth are usually given during autumn or early spring when the grass is making a certain amount of growth, and at this rate a cubic yard would cover about 300 square yards of surface. Lighter applications can also be put on at almost any period of the year.

TOP-DRESSING

Sea sand is sometimes criticised because of the amount of lime present. If it is objected to on this account, it is quite safe to use inland sand, provided it is sharp. The best material is that which is moderately coarse and contains no appreciable amount of clay.

Coke Breeze. A cheap and fairly effective substitute for sharp sand is fine coke breeze, used in the same manner but at the rate of 1 cubic yard for every 1,000 square yards.

It is an advantage to prick the surface of a lawn with a fork or a spiked roller before giving a heavy dressing of sand or breeze. After broadcasting the material as evenly as possible, work it into the turf with a stiff broom or the back of a rake, and finish off with a light rolling. If conditions permit, the turf should be lightly swept and rolled every day for about a week, in order that the sand or breeze may become incorporated in the shortest possible time. Damp soils may also be improved by rolling in pieces of coke breeze or cinders about a $\frac{1}{4}$ -inch to $\frac{1}{2}$ -inch in size.

Charcoal. A dressing of charcoal at the rate of 1 pound per square yard is exceedingly valuable when a lawn is liable to become badly saturated. Pieces ranging between a $\frac{1}{4}$ -inch and $\frac{1}{2}$ -inch in size are best for the purpose. Following the distribution, put a light roller over the ground. The charcoal, being a powerful absorbent, will relieve the soil of moisture.

Compost. On dry sandy soils it is an advantage to spread over the grass a thin layer of sifted leaf-soil, or thoroughly rotted manure, finely broken up, in November. Stir the material occasionally with a rake and sweep off any loose remnants before the first cutting in February or March. Even better results are obtained by preparing a manure dressing or compost, and giving light applications throughout the autumn and winter. For lawns on sand, gravel or chalk such dressings are a necessity. They are also valuable on many other types of soil.

It is advisable to make provision for preparing and storing compost in the dry, otherwise it cannot be handled properly or kept in a good condition for use. Moreover, a great deal of nitrogen is lost if compost is stored in the open. Of course, there is always danger in introducing weed seeds with compost, and if possible an opportunity should be given for some of these to germinate before the material is used for top-dressing. Compost should be stacked for at least twelve months, and before use it should be passed through a $\frac{1}{4}$ -inch mesh screen. It should be applied to the turf in several light doses; no single dressing should be greater than about 1 cubic yard to every 200 square yards, but as soon as this is assimilated a further quantity may follow.

For top-dressing lawns on dry sand or gravel, a compost of 2 parts good light soil and 1 part well-rotted manure will be found most suitable for use in autumn or winter. On medium land 2 parts of the natural top soil with 1 part each of sand and well-rotted manure will answer. Where the soil is heavy, sharp sand should form a good proportion of the compost.

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Good leaf-mould is an excellent substitute for well-rotted manure. It is rich in humus and does not spoil the appearance of lawns. In addition, leaf-mould is less liable to carry weed seeds and is therefore a useful ingredient of compost that must be hastily prepared. Failing a supply of manure or leaf-mould, compost dressings can be made with peat preparations. The latter are valuable as a source of organic matter but possess very little fertilising value, since the nitrogen, phosphate and potash present are usually in a very inactive form. A mixture of peat, rotted manure and soil often develops into a very useful compost.

Lime. It is a recognised fact that certain fine grasses will grow satisfactorily on soil which is acid owing to a deficiency of lime, and on this account it is sometimes suggested that lawns should be made artificially acid—say by means of dressings of sulphate of ammonia, which gradually deprive the soil of lime.

According to our experience, excellent turf can usually be cultivated on slightly acid soil, but we consider it wise to refrain from going to extremes. The treatment necessary to produce an artificial state of acidity (if not too prolonged or intensive) may not injure some soils, but other types may prove a difficult proposition. Any attempt to make some of the heavy soils strongly acid can easily result in sour and stagnant turf, a very different thing from turf growing on an acid soil which is properly open and porous.

There are many occasions when dressings of lime are needful to counteract excess acidity, sometimes indicated by poor thin turf with bare ground, and patches of Yorkshire Fog, and there may also be certain fungoid growths which require similar corrective treatment.

Carbonate of lime is a gentle and safe form for use on lawns. It exists as ground limestone, powdered chalk, or in the finely divided residue from water-softening processes. From 2 to 4 ounces per square yard may be applied in late autumn.

CHAPTER ELEVEN

THE DESTRUCTION OF WEEDS

ESTABLISHED TURF becomes weedy from various causes. Weeds are always present in waste ground and their seeds are frequently conveyed to lawns. Some seeds travel a long distance on the wind, and in various other ways weeds are spread about through the agencies of nature. Soil dressings also may be responsible for the introduction of weeds. In a thick well-nourished turf it is difficult for weeds to develop to any considerable extent, and one of the best means of guarding against their encroachment is to maintain a full plant of grass.

Many methods have in the past been employed to deal with weeds, such as removing each plant by hand or injecting a strong acid into weeds with fleshy tap roots, while the use of Lawn Sands, containing appropriate proportions of sulphates of ammonia and iron, is still a popular method of control either by large-scale distribution or by 'spot' treatment.

The discovery of the means of producing synthetic compounds, known as 'Selective' Weed Killers, revolutionised the weed problem to an extent which may best be illustrated by a comparison of the old and new ways of dealing with Plantains. Previously, these weeds presented an almost hopeless problem if they were present in such large numbers as to rule out individual treatment. Now, however, Plantains are so easily disposed of by the use of Selective Weed Killers that there is no necessity to carry out hand-weeding.

Selective Weed Killers may be applied either in the form of a solution or as a powder, and the former is, as a rule, slightly more effective than the latter. There is no scorching action upon the plant as in the case of Lawn Sands, but the effect is comparatively gradual for a few weeks after the leaves of the weeds have absorbed the chemical until collapse occurs. In the intermediate stages the stems and leaves become curiously distorted. It is important that no definite conclusions should be drawn after only a week or two, for it may be necessary in some cases to wait as long as six to eight weeks for the complete disappearance of the weeds.

The best time to carry out the treatment is when the weeds are in active growth, so that late autumn and winter are not the most suitable periods.

It is good policy to apply a nitrogenous fertiliser a fortnight before spraying, for this will not only accelerate the destruction of the weeds, but also give assistance to the grass in filling up the bare spots caused by removal of the weeds.

These preparations are 'selective' in the sense that, while destroying a wide range of weeds, they have little effect on the grass. There may be a slight check, but even that may be counteracted if the fertilising mentioned above is adopted.

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Of course, caution should be exercised as regards applying the preparations in the heat of the summer, unless watering can be carried out, if required, from a few days after treatment. It is best to apply Selective Weed Killers when rain is not expected for a day or two, and it is advisable to refrain from mowing for a period of about three days before and after treatment.

Selective Weed Killer solutions, after being diluted with the appropriate quantity of water, may be applied by means of a pressure sprayer or a watering can with a fine rose. Considerable areas of turf can be sprayed in a very short time with large-scale apparatus.

It is important that the spray or dust is not allowed to drift on to flowers, vegetables, shrubs or trees, as these may be adversely affected. For this reason it is good policy to put aside receptacles specially for use with Selective Weed Killers, as the slightest trace of one of these chemicals left in a watering can would be sufficient to cause injury to greenhouse plants or seedlings beings raised for planting out, if watered with the can. If, however, this is impracticable, such containers should be thoroughly cleansed before being used for other purposes.

It will be seen from later paragraphs that there are some weeds which are not susceptible to Selective Weed Killers. One of the most stubborn is Yarrow, while there are others, such as White Clover and Pearlwort, where only partial control may be obtained. There are therefore cases where Lawn Sand treatment is still useful, and in some instances it can be a good supplement to the Selective Weed Killers.



TURF INFESTED WITH PLANTAIN, CAT'S-EAR, ETC.

The area on the right was treated with Selective Weed Killer one month previously.

THE DESTRUCTION OF WEEDS

Our 'Clensward' Lawn Sand is excellent for the work, while it also destroys moss which is not affected by the former. This dressing should be applied at the rate of 4 ounces per square yard (10 cwt. per acre) when there is a prospect of a day or two without rain. While it has a temporary discolouring effect upon the grass, the turf quickly recovers and responds to the stimulant in the preparation.

The following are some of the most common weeds encountered in established turf:—

Buttercup. The Common Crowfoot and Creeping Buttercup can be reduced by Selective Weed Killer, but the bulbous type is more resistant.

Cat's-ear. This is somewhat similar to the Dandelion in appearance, but the leaves are hairy. Good control can be obtained with Selective Weed Killer.

Lesser Celandine. This weed has dark glossy leaves and the flower is similar to that of a Buttercup, although it is seen much earlier in the year. It spreads quickly by means of tubers, and the only remedy is the removal of the plant together with the tubers. Celandine flourishes in damp, shady situations.

Clover. White Clover, Hop Clover, Yellow Suckling Clover, Yellow Trefoil and Birdsfoot Trefoil are the varieties most frequently found in lawns.

The most troublesome species is White Clover. Its total elimination is not always easy, owing to the manner in which the plant spreads and intermingles with the grass. Selective Weed Killer will generally effect some reduction, but further measures also are necessary. Much of the clover can be removed by raking up the creeping stems and shaving them off close to the ground or plucking them out, following with an application of Anti-clover Dressing. This treatment should be repeated as often as necessary.

Hop Clover, Suckling Clover and Yellow Trefoil are annuals, and should be treated with Anti-clover Dressing or Selective Weed Killer before the plants have an opportunity of setting seeds.

Birdsfoot Trefoil shows a preference for thin calcareous soil, and can be dealt with by Selective Weed Killer.

Daisy (Common). While a fairly good reduction can generally be obtained by the use of Selective Weed Killer, it may be necessary to follow up by using 'Clensward' Lawn Sand, preferably in the autumn.

Dandelion. The best means of eradication is to use Selective Weed Killer.

Hawkbitt. Another tap-rooted plant with a somewhat similar habit to the Dandelion and equally susceptible to the use of Selective Weed Killer.

Mouse-ear Chickweed. Can be reduced by Selective Weed Killer, supplemented later with 'Clensward' Lawn Sand. Generally flourishes in light soil deficient in

WEEDS COMMONLY FOUND IN LAWNS



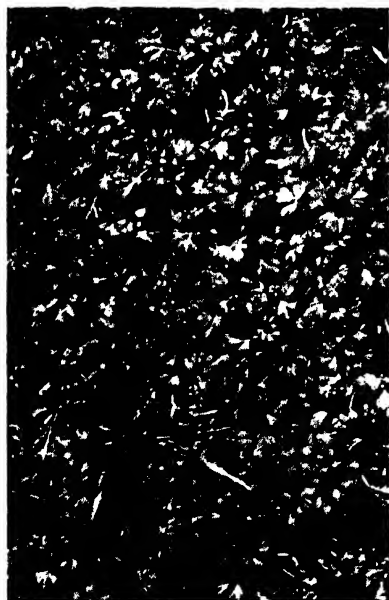
CAT'S-EAR.

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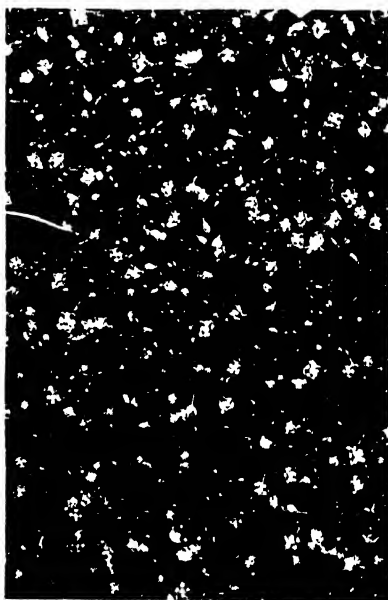
DAISY.

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PARSLEY PIERT.

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PEARLWORT.

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THE DESTRUCTION OF WEEDS

potash and nitrogen, and applications of these fertilisers have frequently resulted in a distinct decrease in this weed.

Mouse-ear Hawkweed. A perennial species, with long leafy runners and entire oblong leaves, thickly covered on the under surface with white hairs. It is most prevalent on dry chalk soils. Can easily be disposed of by Selective Weed Killer.

Parsley Piert is a small annual weed with three-lobed leaves and minute greenish flowers. It is chiefly confined to dry soils, and often appears when turf has been injured by drought or the excessive use of nitrogen. Rake out the weed, and pay special attention to fertilising and renovation with grass seeds where necessary.

Pearlwort. Being somewhat similar in appearance to grass in the early stages, this weed often remains unnoticed until strongly established. If possible, spray with Selective Weed Killer when the flowering heads have formed but before they have a chance to set seeds. Apply fertiliser about a fortnight previously. In the autumn use Sutton's Special Pearlwort Lawn Sand dressing.

Plantain. All varieties, including Starweed, Buckshorn Plantain or Sea Plantain, can easily be dealt with by Selective Weed Killer, and hand-weeding is now quite unnecessary.

Sea Milkwort and Sea Pink (or Thrift). These weeds are commonly found in sea-washed turf, but are susceptible to Selective Weed Killers.

Self-heal. This troublesome weed is found chiefly on heavy or damp soil, and its presence in abundance is sometimes due to defective drainage. As it is susceptible to Selective Weed Killer there should be no difficulty in getting rid of it, but it may be desirable to pay special attention to fertilising or renovation with grass seeds at the proper season.

Sorrel. The presence of Sorrel is generally an indication of soil acidity. Selective Weed Killer will give some measure of control.

Woodrush. A perennial plant which grows freely in dry pastures and heaths, or wherever the soil is light and deficient in humus. Woodrush resembles a somewhat coarse grass, but can be distinguished by the tuft of hairs in the heart of the plant. It has strong creeping roots and is difficult to remove by hand, but it is discouraged by one or two applications of 'Clensward' Lawn Sand, supplemented by regular dressings of our Lawn Fertiliser.

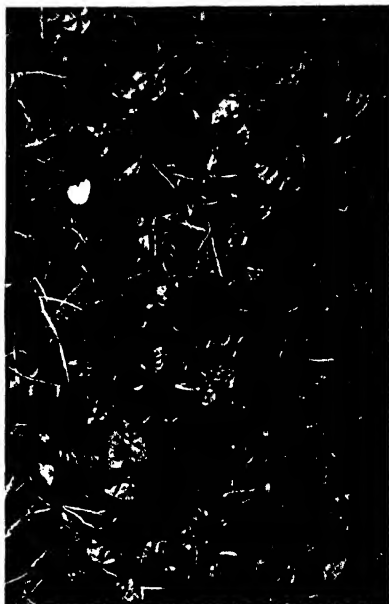
Yarrow. The presence of Yarrow in a lawn is usually considered undesirable, although the herbage can be kept reasonably fine under close mowing. Occasionally it appears so persistently that constant attention is necessary to keep it down. Yarrow is most abundant on dry, sandy, gravelly, or chalky soils, deficient in nitrogen and humus. When established to any degree, it is difficult to eradicate. Stripping the turf and digging over the underlying soil to remove every scrap of root is the most direct method. Repeated defoliation is a means of weakening the plant, which is not very susceptible to Selective Weed Killer. (See also page 25.)

WEEDS COMMONLY FOUND IN LAWNS



PLANTAIN.

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SELF-HEAL.

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SORREL.

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YARROW.

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THE DESTRUCTION OF WEEDS

Coarse Grasses. Coarse grass is a comparative term, according to the quality of the turf and the purpose for which it is intended. Broadly speaking, the demand to-day is for lawns of the finest texture, and grasses with a tendency to strong growth are objected to. The difficulty with coarse grasses is that they are invariably encouraged by the manurial treatment which is necessary for the turf generally. The only remedy, therefore, is to remove undesirable species by the ordinary process of hand-weeding. By far the commonest coarse grass on lawns is Yorkshire Fog. The only really effective remedy is to cut out the patches and lay sound turf, or sow grass seeds after making good the level with soil. Yorkshire Fog is greatly encouraged by the excessive use of sulphate of ammonia.

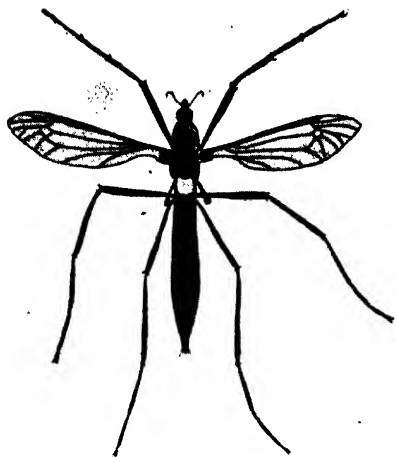
Annual Meadow Grass. It is not uncommon to find an old lawn largely, if not entirely, composed of Annual Meadow Grass. With considerable care and attention it is possible to keep such turf satisfactory, although it may be rather soft and possess a peculiar tinge at certain seasons. Turf composed of Annual Meadow Grass, however, is extremely sensitive to the weather, and is very liable to die off in patches following periods of drought or severe cold, while it is also one of the first grasses to collapse when attacked by fungus. While recovery may be comparatively rapid, the bare spots afford an opportunity for weeds to become established

Close cutting will not destroy Annual Meadow Grass, for it does not prevent the shedding of seed. The only remedy we know is hand-weeding, and those who value a verdant lawn will do well in taking some trouble to remove by hand any specimens which may become established. Unfortunately, the presence of this grass is not always noticed, and owing to the freedom with which seed is produced it quickly becomes intermixed with the turf, and is then very difficult to deal with.

Annual Weeds. (See illustration and reference on pages 26 and 28.) Weeds such as Shepherd's Purse, Common Chickweed, Goosefoot, Mayweed and Groundsel often appear in newly-sown turf, but as a rule they disappear rapidly under mowing. They are occasionally introduced through the medium of compost or soil top-dressings.

Bindweed or Convolvulus. This climbing plant, which is a common weed of the garden, sometimes occurs in a newly-sown lawn. It does not, however, persist in closely mown turf, and will ultimately disappear, although perhaps not so quickly as the annuals.

Couch Grass. This is another plant which is only too well known in gardens and arable land and possesses extensively creeping white rhizomes, one small piece of which can produce another plant. This grass does not appreciate regular cutting, and will in due course be crowded out by the legitimate lawn grasses when regularly mown.



CRANE-FLY AND LARVA (LEATHER-JACKET).
(Natural size.)



BIBIO FLIES (FEMALE AND MALE) AND GRUB.
(Magnification $\times 2$.)



COMMON CHAFER BEETLE
AND GRUB (natural size).



GARDEN CHAFER BEETLE
AND GRUB (natural size).



SUMMER CHAFER BEETLE
AND PUPA (natural size).

CHAPTER TWELVE

TURF PESTS

Worms. Worm casts, when numerous, are a source of considerable trouble on lawns, particularly where the turf is used for play. The continual movement of the worms in the soil and the amount of soil thrown up by them cause difficulty in mowing and rolling and make it impossible to maintain a true surface. Further, the muddy surface which they create provides an ideal medium for the germination of weed seeds, and a good deal of fine grass may be smothered by casts which are flattened out under the roller.

There are several methods by which worms may be removed, but some of the remedies are highly poisonous and require very careful application or damage may result. The safest and, at the same time, most effective way is to use one of the organic preparations supplied in finely powdered form, such as Non-poisonous Worm-killing Powder, by means of which large numbers of worms are killed at the surface and many die beneath the ground. The powder needs only to be spread at the rate of 1 ounce per square yard and is best watered in, although it is quite effective if left to be washed in by heavy rain.

In the destruction of worms it is of importance to choose a period when they are working freely. During humid weather worms are usually very active, but in drought or frost they are driven below and there is very little evidence of them. Generally speaking, the best periods for carrying through the work are autumn and spring.

Leather-jackets are the grubs of the Crane Fly, or Daddy Longlegs (family *Tipulidæ*), and they do a great deal of harm in turf. The eggs are laid in summer or autumn, and generally the larvæ appear within a fortnight. As the grubs grow older, they feed on the grass roots, etc., and are particularly injurious to turf in the spring, when they move about freely. The grubs pupate in the soil when full grown, and the pupa is so constructed that it wriggles to the surface by means of its spines when the fly is ready to emerge. The pupa-case is usually left half-way out of the ground after the fly has escaped.

Preparations containing D.D.T. or Gammexane are excellent for controlling these grubs, which should of course be dealt with as soon as they are known to be present. In order to ascertain if turf is infested with Leather-jackets it may be necessary to carry out tests with an expellent, and for this purpose our 'Sunningdale' Solution is very effective, as the grubs come speedily to the surface.

It is important to bear in mind that when turf has been weakened by an attack of Leather-jackets or other pests, it is most desirable that the grass be encouraged by dressings of fertiliser.

The use of lead arsenate, which is a poison, is sometimes recommended for the control of Leather-jacket grubs and also worms.

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Bibio Grubs. From time to time we receive for examination samples of turf which are infested with small grubs, the most common of which are of the *Bibionidae* family. They are often introduced in rotted manure. Some of these grubs feed upon the roots of the grass, but they rarely do any appreciable harm unless present in great numbers, and may easily be destroyed by D.D.T. preparations. These grubs are often confused with Leather-jackets, but may be distinguished by their smaller size, paler colour, and distinct head which is a chestnut brown in colour. Leather-jackets are much tougher in texture, dark greyish in colour, and the head is hardly visible.

Chafer Grubs are the larvæ of Chafer Beetles, often seen on the wing during May, June and July. Three species are frequently found in lawns, viz., the Common Cockchafer (*Melolontha melolontha*), the Garden Chafer (*Phyllopertha horticola*), and the Summer Chafer (*Amphimalus solstitialis*).

The beetles of the Common Cockchafer appear in May, and the grubs live for from three to four years. In the first year of their larval life they do little damage, but during the second and third years they eat the grass roots, and where the grubs are numerous severe damage may be done to the turf.

The Garden Chafer is popularly known as the 'June Bug' as it usually appears in large numbers in June. The beetles are much smaller than the other two species, and are diurnal (daytime) flyers, preferring bright sunny weather. The complete life cycle of this type is one year.

The Summer Chafer occurs in July, and its life cycle is from eighteen months to two years.

Chafers prefer light sandy types of soil, especially areas surrounded by copses or woods. Turf which has suffered from a severe attack by the grubs can usually be identified by its soft springy texture, and can be rolled back like a carpet, due to the severance of the roots. Rooks are often responsible for much damage because they tear up the turf in their efforts to get at the grubs.

These grubs are difficult to get rid of, but some success has been obtained with lead arsenate, and preparations containing D.D.T. and Gammexane.

Ants are sometimes a nuisance on lawns early in the year. They throw up heaps of fine soil in the night, and this is repeated until swarming takes place. We can supply a preparation for destroying ants, particulars of which may be had on request. Carbon bisulphide, injected into the ant hills by means of an engineer's oil can, has also been recommended for the purpose, but the chemical is an extremely inflammable one. If it is used, great caution is necessary.

Moles. Trapping is generally the most convenient means of dealing with these creatures. Gloves must be worn to avoid touching the traps and the surrounding earth with the hand, and the arrangements should be carried out by a man experienced in the work.

THE DISEASES OF TURF

IN ADDITION to the trouble caused by weeds and earthworms in lawns, there are other rather more obscure difficulties due to various forms of fungoid growths, but, as a rule, they are only encountered where the turf is in an unhealthy condition.

The remedies mentioned below have been found effective in checking various fungoid growths, but immunity from future attacks can only be secured by discovering and removing the underlying cause of the trouble. If it is due to an excessively acid condition of the soil, a light dressing of carbonate of lime will prove the most effective antidote. In other cases, top-dressing with a fertiliser is desirable, or the turf may require pricking in order to render the surface more porous. In extreme instances it will be necessary to overhaul the drainage system before the root of the trouble is reached.

Corticium Disease (*Corticium fuciforme*). This fungus frequently attacks the finer-growing grasses in lawns. In one stage it takes the form of pink or red gelatinous growths attached to the stems and leaves, sometimes joining the blades together: hence one of its common names is Red Gelatinous Mould (formerly known as *Isaria fuciformis*). It also produces thin short attachments of a similar colour which stand out prominently from the withered leaves. It is important that all grass cuttings affected by this fungus should be destroyed, for not only do the attachments survive when broken off, but large numbers of spores also are produced and may be disseminated. Fortunately this fungus does not cause such high mortality among the grasses as some diseases, but it may result in large portions of lawn assuming a bleached appearance during the growing season.

Corticium may be checked by spraying with Sutton's Sanisward, and several preventive sprayings in the spring should greatly reduce its incidence. In our experiments we have found that Corticium is liable to be much more prominent on those plots which did not receive fertiliser than on those which had regular manurial dressings.

Damping-off. A sowing of grass seeds is sometimes temporarily spoilt by 'damping-off,' especially if germination is followed by a spell of warmth and excessive moisture. The trouble is attributable to a fungus which attacks the seedling grasses, causing them to turn a reddish colour and collapse at the base. *Pythium* is one of the most common of these fungi.

When the ground is damp the disease spreads rapidly, especially in the autumn, and may cause large bare patches to appear in newly-sown lawns. In the case of a very severe attack it is advisable to check the fungus by spraying the affected patches, together with the surrounding turf, with a solution of Cheshunt Compound at the rate of $\frac{1}{2}$ -ounce in 1 gallon of water per 3 or 4 square yards. If

LAWNS

the attack has not been noticed in time, and bare places occur, some renovation with grass seeds will be necessary.

Fairy Rings. Several different kinds of fungus form the well-known fairy rings which often greatly disfigure lawns. A fairy ring increases in diameter year by year, and each season the fungus occupies a zone outside the area previously affected. It eventually decays and charges the soil with nitrogenous matter which fertilises the grass and causes the dark green rings. The mycelium-infected soil becomes almost impervious to moisture, and it is a common thing for the grass on such rings ultimately to die.

No definite antidote has yet been found for this fungus, and the only certain remedy is to remove the turf and dig out the infected earth to as great a depth as necessary, replacing with clean soil and fresh turf. As an added precaution it is worth while to water the subsoil with a solution of formaldehyde. Add 1 gallon of formaldehyde to 24 gallons of water, and apply at the rate of 2 gallons per square yard, afterwards putting on the top soil. These operations should, if possible, be completed two or three weeks before sowing grass seeds in cases where seeding is preferred to turfing.

Control of the fungus has sometimes been obtained by the following treatment, which may be worth trying before adopting the more drastic course. Deeply fork the turf at very close intervals both on the actual ring and about a foot outside. Water with a solution of $\frac{1}{2}$ -ounce sulphate of iron in 2 gallons of water per square yard, and repeat at intervals of a few weeks.

Fusarium Patch (*Fusarium nivale*). The existence of this fungus is indicated by brown patches, some quite small, and the cottony mycelium is sometimes to be seen during humid periods, either white or with a slightly pink tinge. The affected turf should be sprayed with Sutton's Sanisward, and it is specially advisable to adopt this treatment as a preventive measure, say in early spring or autumn, especially if close damp conditions prevail. The best results are obtained by using the Solution on a dull day, immediately after mowing, but the application should be repeated if followed by heavy rain. In treating areas where the disease is already spreading, spraying should be done at weekly intervals until the grass has recovered.

Lichens. *Peltigera canina*, or Blackish Lichen, is sometimes attributable to lack of proper drainage, a condition which should be rectified. Occasionally, however, it occurs on turf in shady situations, or in poor dry soils where fertilising and mechanical treatment of the surface have been neglected over a long period. During dry weather apply Sutton's 'Clensward' Lawn Sand at the rate of 4 ounces per square yard: a week or two later scarify with a rake to remove the lichen and aerate the surface. Subsequently, fertilising and renovating with grass seeds should be carried out at the appropriate season. Lawns affected by lichen should be pierced with a tubular-tined fork in the autumn, and a dressing of carbonate of lime may then be applied at the rate of 2 ounces per square yard.

THE DISEASES OF TURF

Collema pulposum. This generally occurs in damp situations, or where the soil has become hidebound, and is sometimes known as *Nostoc*. It is not as a rule troublesome during dry weather, but after rain (or heavy watering) it swells into jelly-like masses of a dark green colour. It may be necessary to resort to brushing where it is prominent, and piercing the ground with a tubular-tined fork should create conditions inimical to its appearance. A dressing of sulphate of iron at the rate of $\frac{1}{2}$ -ounce per square yard sometimes acts as a deterrent.

Summer Rust (*Puccinia graminis*). When turf is attacked by this disease, the foliage is covered with an orange-red dust which consists of minute spores shed by the fungus. Immediately Summer Rust is noticed on a lawn, the turf should be mown closely and the cuttings destroyed, while attention should be paid to fertilising. The presence of this fungus often indicates lack of potash in the soil.

Discoloration. Certain kinds of grass, more especially the finer varieties, have a slight tendency to discolour in the early winter. It is often due to the presence of withered leaves which are not readily shed. In other cases, the turf turns yellow in patches, but generally this is the result of frost or cold wet conditions. There is usually no cause for alarm. The grass behaves normally in winter and by spring it has completely regained its fresh green colour.

Other circumstances producing discoloured areas that might be mistaken for the effect of fungoid diseases are:—

1. Stones just beneath the turf.
2. Patches of subsoil near the surface.
3. Hollows where water collects.
4. Root-feeding insects.
5. Scalding by animals.
6. Uneven distribution of artificials.



SHADED LAWNS

ALTHOUGH TREES greatly add to the charm of a lawn, it is always difficult to maintain good turf in their immediate vicinity. They often rob the soil of moisture and plant nutrients, and shut out sunshine, while, in the case of conifers, spines are shed which prove destructive to ground herbage. Damage is repeatedly done by rain dripping from the branches. All these influences tend to the gradual disappearance of grass. Difficulty is also sometimes experienced in establishing healthy turf on areas heavily shaded by buildings.

Turf under trees will generally benefit if the grass is allowed to grow to a little greater length than usual for lawns. Fallen spines should be swept up frequently, and any tendency for moss to encroach must be counteracted by light dressings of Moss Destroyer and by gentle raking. Areas that are directly overhung should have a dressing of carbonate of lime every two or three years, and late autumn or early winter is the best time for such treatment. The amount of lime usually required is 2 ounces per square yard, and any bare ground should be lightly forked over in advance. In spring a liberal dressing of Lawn Fertiliser is most essential to compensate for the impoverishment of the soil caused by the trees, and the artificial should be applied in March or early April. After allowing a few days' interval, renovate the bare places by sowing seeds of a suitable mixture of grasses, and after the seed has been lightly raked in make the surface firm by rolling. Certain grasses endure shade better than others, and we prepare prescriptions which are most likely to thrive under such conditions.

It should be borne in mind that if fallen leaves are allowed to lie thickly on the turf for any length of time they become sodden and hasten deterioration of the grass.

In very unfavourable spots an annual sowing of grass seeds may be the only satisfactory course. For small plots the cost is trifling, and the fresh appearance of the young plant is always attractive. To remove the top soil and lay fresh turf is far more expensive and is seldom as effective, since grass brought from the open and laid in the shade of trees generally dies within a short time.

THE IMPROVEMENT OF POOR TURF

TURF becomes thin and bare from various causes. Unfortunately, the signs of degeneration are apt to be disregarded until severe measures become necessary, involving labour and outlay which might have been spared by timely attention.

The conditions which usually result in the deterioration of turf are:—

1. Hard wear.
2. Soil impoverishment or acute acidity.
3. Prolonged drought in the absence of adequate watering.
4. Defective soil conditions, e.g., light sandy soils; thin soils overlying rock, gravel or chalk; heavy clay.
5. Insufficient drainage.
6. Hidebound surface due to over-rolling or heavy traffic.
7. Densely shaded situations.
8. The presence of worm casts.
9. Fungus or insect attacks.
10. The sowing of an unsuitable mixture of grass seeds.

August and September are the best months in which to undertake the renovation of unsatisfactory turf, and particularly so where the grass is used for games. The soil is then warm and, as a rule, there is sufficient moisture to ensure the rapid germination of grass seeds. Weeds also are less in evidence during autumn than in spring, and the new grass develops quickly. Every effort should be made to sow before the end of September; seeding in October frequently proves successful, but late sowings cannot be relied on.

Circumstances often make it necessary to renovate in spring. The proper time for commencing the work depends on the district. In the southern and western counties of England and in Ireland a beginning of the preparatory work may be made at the end of January or early in February, should the weather be suitable. As the old turf affords some protection to the young grasses, the sowing of renovating seeds about the middle of March is possible in most mild districts. For the midlands and the north the date will necessarily be later. The period for spring sowing usually extends into May, but late renovating, if followed by weeks of hot dry weather, is not very satisfactory; the seedlings, after starting, are destroyed by drought. Where turf that is used for games has to be renovated in spring, early seeding is specially desirable.

The first step in renovating turf should be to mow the grass closely; then scarify vigorously with a rake, in order to open and aerate the surface and prepare a suitable tilth for the reception of grass seeds. This latter operation is particularly necessary when the surface has become hard through constant rolling and traffic. The entire area should be scarified in two directions, at right-

THE IMPROVEMENT OF POOR TURF

angles; the immediate result may be apparent ruin, but actually the grass will speedily recover and eventually derive considerable benefit.

The question of aeration is also important, and attention is directed to the recommendations on this subject made on page 32.

Raking or pricking, though beneficial in itself, is not alone sufficient. It must be followed by a top-dressing of manure, and for the purpose there is nothing better than our Lawn Fertiliser, which contains the essentials for promoting a healthy growth of grass. On very light soil a compost of well-rotted manure and fine soil may be used instead, to be followed by a dressing of artificials at a later period. The heavier types of soil will be improved by mixing an equal quantity of sharp sand with the artificial. All such top-dressings should be brushed in. After a few days' interval sow a renovating prescription of fine grasses at the rate of 1 to 2 ounces per square yard, according to the condition of the turf. Thinly cover the seeds with fine soil or sand, and complete the work by firmly rolling down in two directions.

Better results are invariably obtained by the procedure outlined in the preceding paragraphs, than by patching with turf probably different in texture from the remainder of the lawn.

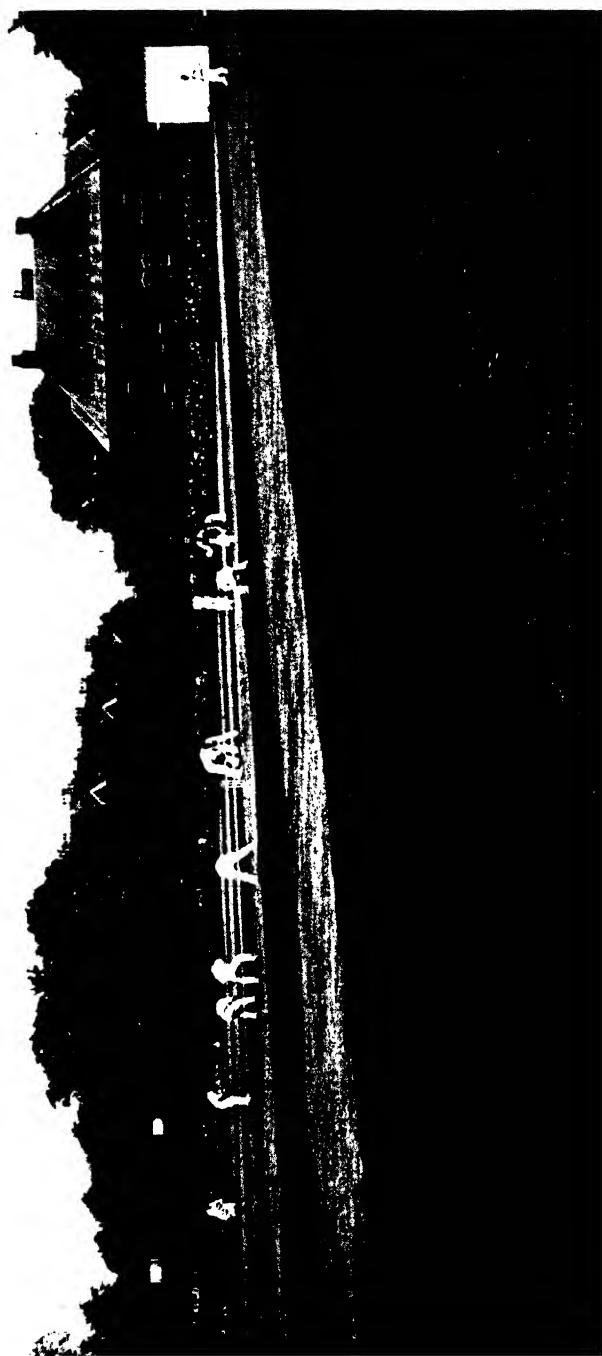
We are occasionally asked whether the herbage of a lawn which is thin might not be thickened by allowing the grass to flower and shed seeds. A more disastrous course could not be pursued. It has exactly the opposite effect to that desired, and greatly weakens the standing plant. The small amount of seed produced will include coarse varieties and also weeds.

MOSS

Moss is often a source of trouble in turf. It interferes with the growth of the grass and prevents proper aeration of the soil. Fortunately, moss can easily be dealt with by means of the Destroyer we supply for the purpose, which has merely to be spread at the rate of 2 ounces per square yard when there is a prospect of a few days without rain. The preparation acts quickly, and in a week or two the dead moss can be detached by a light raking. For a short time the grass may appear scorched, but it rapidly recovers and is all the better for the dressing. Bare places must be sown with suitable grass seeds after an interval of a fortnight.

There is always an underlying cause for the appearance of moss, and unless this is removed the trouble may recur. Sometimes moss is only a temporary winter growth, due to slight excess of moisture in the surface soil. This type of moss generally disappears at the end of the winter and causes little trouble. A more persistent growth of moss, associated with a thin plant of grass, is almost invariably due to impoverishment, and here the remedy is obvious. After dealing with the moss by means of the Destroyer referred to, it will be necessary to top-dress regularly in spring and autumn with suitable manures until the surface soil is restored to a thoroughly fertile condition. Moss appears also on lawns which are imperfectly drained or excessively acid, and will continue to cause trouble until the condition is rectified.

FENNER'S, CAMBRIDGE, AUSTRALIA v. CAMBRIDGE UNIVERSITY.



SPORTS GROUNDS

CHAPTER SIXTEEN

CRICKET GROUNDS

THE IDEAL arrangement for a sports ground is to provide separate areas for winter and summer games, but this is rarely possible in practice. Much of the turf has to serve for football or hockey pitches from September to April and comes into use for the remainder of the year as the cricket outfield. To meet these requirements, the turf must be assisted by adequate fertilising and such mechanical processes as harrowing and aerating. The periods of rest, however, are all too short and allow little time for the intensive renovating treatment which has sometimes to be carried out.

The area of the cricket table must obviously be reserved for summer use only, or it will be impossible to provide satisfactory pitches. The extent of this area is governed chiefly by the amount of play likely to take place. A cricket pitch measures 22 yards long; the popping crease is marked 4 feet from the wicket and the width of the bowling crease is 8 feet 8 inches. It is therefore possible to play cricket on a level piece of turf 22 yards by 3 yards, but the usual practice is to lengthen the levelled area a few yards and extend it sideways so as to provide several pitches. With only one match per week a levelled area measuring 25 yards by 25 yards would make a good cricket table. Where it is likely to be in constant use, the dimensions of the table should be increased and 40 yards by 30 yards would be a useful size.

The establishment of a good cricket table is not always a simple matter. Nevertheless, the expense and trouble are well worth while when it is borne in mind that once the square is properly laid out there should be no difficulty in preparing first-class wickets and, indeed, little need for the highly artificial treatment given to many cricket squares in an effort to secure firm pitches.

The area of the table must be free from undulations and it should be made as level as the adjacent ground permits. A slight fall is permissible, but anything approaching a decided slope will be objected to by both batsmen and bowlers, and sometimes it is necessary to modify the contours of much of the surrounding outfield, as well as the table itself, before a satisfactory result can be obtained.

To ensure a good turf for wickets the soil should be capable of supporting a dense plant of grass and of such a character physically as to enable the groundsman to prepare a firm and true pitch. It follows, therefore, that the heavier types of soil are favoured, provided there is adequate drainage. If this does not exist naturally, it must be provided either by a system of 3-inch drain pipes laid in parallel lines 10 or 12 feet apart and connected to a main drain outside the table,

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or by means of an ash foundation 6 to 9 inches beneath the turf. The latter mode of drainage is well worth while where the subsoil is an impervious clay.

Sharp sand may be thoroughly incorporated with the top few inches to improve the surface drainage of heavy soils, but on a pure clay it is better to replace the top few inches with good loam.

It is soils of the lighter type that give most trouble in the establishment of a good cricket table. No amount of rolling will bind a sandy surface into the firm condition essential for the severe wear of a cricket match, and the only satisfactory course is to obtain sufficient heavier loam to replace 4 to 6 inches of the existing soil.

New cricket squares are often laid with turf, so as to ensure the establishment of a durable surface in the shortest time. It is of some importance to choose turf that consists of really hard-wearing grasses and is free from clover. The chief need being for a deep-rooted grass that will resist harsh treatment, it will be found that some of the Poas, Crested Dogtail and even wild forms of Perennial Rye Grass are better than the very fine grasses and surface-creeping types with shallow root-growth.

To establish good wickets from seed takes time, although the use of a specially arranged prescription of grasses will do much to hasten the development of the turf. Where sowing has to be relied on, it is well to allow 2 ounces of seed per square yard.

The upkeep of the turf during the season is largely a matter of frequent watering and small dressings of fertiliser. For an important occasion, two or three days are spent in preparing a wicket by repeated raking, mowing, and rolling until the surface is firm and true and only just barely covered with grass. If watering is necessary, it should be carried out well in advance of the other work so as to allow the pitch to dry out to some extent before use.

After a match, reconditioning of the pitch should commence at once. The extent to which each wicket can be renovated following play depends on a number of circumstances. When wickets are needed for a whole day or longer, some system of working across the table must be adopted in order to avoid over-lap and to allow the maximum period of rest. Worn and uneven spots should be repaired by raking and sowing seed of our 'County Wicket' prescription, but holes made by the batsmen or bowlers are best repaired with turf, reserve plots of which should be sown and kept in the same condition as the pitch. Water the turfed areas well, and carefully roll.

Wickets used for half-day matches receive less damage, but as they will probably be required again in a short time the turfing of badly worn spots must be deferred until the end of the season. Meanwhile, renovation with seed and light dressings of fine soil and fertiliser, combined with frequent watering, will do much to restore the turf. The best fertiliser for a cricket square is a complete one, containing both organic and inorganic constituents.

Since the preparation of wickets entails so much watering and rolling, it is not surprising that the turf at the end of the season is usually in a very consolidated

CRICKET GROUNDS

state and in need of much renovation. Commence work by piercing the ground well with an aerating fork driven in as deeply as possible and at close intervals: then repair large bare areas with new turf and top-dress with compost and fertiliser. Subsequently, recondition all other damaged places by sowing grass seeds, cover thinly with soil and finish by rolling.

If the weather is very dry at the end of the season, it may be necessary to defer aerating and turfing until November or December, although it is wise to attempt this work at the earliest opportunity even if it means soaking the pitch well a day or two beforehand.

During winter a mower with the knives set high can be put over the square once or twice if the weather is mild, and an occasional brushing is beneficial. The bulk of the pre-season rolling must be left until March and April, during which period there are many occasions when a roller can be used to good effect as, for instance, when the surface is drying off after rain. As soon as growth starts, apply 2 ounces per square yard of compound turf fertiliser.

Divergent opinions exist as to the desirability of using Nottingham Marl as a general practice, although we think it is more or less accepted that it is a great aid to preparing wickets on the lighter classes of soil.

Nottingham Marl is a kind of red clay containing a variable amount of lime, and if taken from below the level of the top soil is naturally devoid of fertility. Its chief effect is to harden the surface of a pitch and prevent crumbling, and for this reason marl is often recommended as a means of overcoming difficulties caused by unsuitable soil conditions. In times past, heavy applications were common, but they undoubtedly have an adverse effect on the turf in tending to form non-fertile layers in the surface.

We think the utmost that should be put on a pitch in one year is 7 pounds of marl per square yard, but usually from 4 to 5 pounds is sufficient. This should be put on in two or three dressings during autumn and early winter. An even better plan, in the case of poor soil, is to prepare a compost of 1 part of marl with 3 parts of good medium to heavy top soil and use this at the rate of 7 pounds per square yard, giving a maximum of three such dressings in one season. Some practical groundsmen have been able to dispense with Nottingham Marl altogether and to restrict their top-dressings to fertile soil of heavy character. The use of marl or clay, in water, during the season is not now regarded as an indispensable item in the routine of preparing a cricket pitch for a special event.

While the condition of the cricket table is of first-class importance, it must not be forgotten that the full enjoyment of the game depends partially upon the ability of the ball to travel evenly to the boundary. Regular attention should therefore be given to the outfield, not only as regards routine operations, but also in respect of renovation at the end of the season, particularly following a drought.

Many outfields are full of weeds, such as plantains and dandelions, and are therefore a potential danger to the square owing to the dissemination of seeds. A 'selective' weed killer can be used at almost any time during the playing season, with practically no interference with play, and this applies both to the square and the outfield.

ARSENAL STADIUM.



CHAPTER SEVENTEEN

FOOTBALL AND HOCKEY GROUNDS

THE MAINTENANCE in first-class condition of football and hockey grounds is one of the most important and most troublesome of a groundsman's duties. It is rendered difficult by the general conditions under which these two games are played, and by the fact that but few grounds in the country have been specially constructed for football and hockey and the necessary attention paid to such vital points as soil, turf and drainage.

From September until May, football and hockey are regularly played under conditions often varying between sun-baked grounds at the beginning of play and mud, snow, slush and frost later in the season. In addition to one or two matches a week, many of the best-known grounds in the country are in almost daily use for training purposes. A groundsman would be a brave man indeed if he endeavoured to prevent play owing to the ground being unfit and such a thing would be almost impossible in the case of the principal League games. The muddy conditions which so often persist from November to March render the surface soil favourable for the subsequent propagation of a great number of weeds, in particular, plantains. In no small degree this muddy condition is due to the fact that the natural surface drainage is totally inefficient or that the ground does not possess a thorough system of pipe drainage.

From the above it will be seen that there is ample reason to account for the fact that so many football grounds are found in such unsatisfactory condition. To overcome this, much may be done by putting in hand a complete course of renovating treatment every year. In the case of many football grounds, play often goes on until well into May. This is often not the ideal month for cultivation work and the sowing of grass seeds. As, however, time is of the utmost importance the work must be commenced at the earliest possible moment after play ceases.

First, mow the grass closely and then run an aerating machine over in two directions. This will help to correct the unsatisfactory surface conditions caused by frequent rollings in wet weather, due to the necessity of securing a playing surface. Suitable aerating machines for drawing behind a tractor or a motor mower are now available.

A dressing of fertiliser should then be evenly distributed, and for this purpose a mixture of as complete a character as possible should be chosen, i.e., one containing nitrogen, phosphoric acid and potash in suitable proportions and condition of availability. The rate of application will, of course, depend upon the constitution of the mixture, but a usual amount is 5 cwt. per acre. Thus for a ground measuring 120 yards by 80 yards, 10 cwt. of fertiliser would be required.

The next operation should be a really thorough scarifying with a heavy spiked harrow or even with a Pitch-Pole harrow, followed by chain harrowing. The object of this is to provide a tilth suitable for the reception of renovating seeds, hence the necessity for its thorough performance.

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On the loosened surface thus created, a suitable mixture of grass seeds should be sown. The prescription used should be of a rapid-growing character and should, therefore, contain a sufficient proportion of Perennial Rye Grass. At the same time the necessity for the inclusion of an adequate quantity of the finer grasses which contribute so greatly to the formation of a close, dense sole should not be overlooked. Very often a percentage of White Clover is included to help form a 'bottom', and in cases of extreme soil conditions it is sometimes necessary to prescribe a special mixture containing such unusual species as Yarrow.

Seeds are generally sown at the rate of not less than 2 cwt. per acre in order to ensure the quickest possible result and to produce a turf which will stand up to the maximum hard wear. For a pitch measuring 120 yards by 80 yards, from 3 to 4 cwt. of seed would be required, according to the condition of the turf. In the case of private Club Grounds where wear and tear are not nearly so heavy, the above quantities can often be reduced.

It affords very valuable assistance if the seeds can be covered to a depth of about a $\frac{1}{4}$ -inch with a dressing of clean, light, loamy top-soil which has been previously sifted. This will ensure even covering of the seed and will also constitute a valuable top-dressing. For a football ground of the dimensions already given, about 70 cubic yards would be required. The final operation should be putting over a light roller in two directions.

The goal areas which are usually entirely devoid of grass are best repaired by laying new turf.

Having regard to the season of the year at which the work has to be carried out in order to ensure success it is, of course, essential to have available a really adequate supply of water.

As soon as the new grass is 3 or 4 inches high it should be lightly rolled with a wooden implement and then 'topped' with a mowing machine set high. This can advantageously be followed by a further light rolling, if the ground is sufficiently dry. During the next few weeks mowing and rolling ought regularly to take place. Frequent cutting is very desirable, but care should always be exercised not to cut the grass too closely. With perseverance, this treatment should, by the end of August, produce a thick sward capable of enduring a considerable amount of hard wear. Of course, the heavy use the ground has to undergo during the playing season must always result in some damage to the turf, to repair which the renovating process we have described must be repeated each year, as soon as the last match has been played. By its adoption (assuming that other conditions are favourable) the necessary steps will have been taken to arrest the deterioration which so often takes place and to ensure the pitch being in the best possible condition for the opening of the following playing season.

As regards weeds, plantains and various other types which so often infest football grounds can now easily be dealt with. When, however, the programme of renovating treatment, carried out in April or May, includes a sowing of grass seeds, the use of a 'selective' weed killer should be deferred for two or three months, so that the young grass may have a good opportunity of becoming established before the spraying takes place.

BOWLING GREENS

THE POPULARITY of bowls is such that it has become an integral part of the world of sport, and there is a widespread demand for greens that will afford every facility for cultivating a high standard of play. In some parts of the north and in the midlands, the crown green with a raised centre still enjoys a large measure of popularity, but elsewhere the majority of greens constructed in recent years are of the dead level type.

There is but little difference between the construction of a flat green and a crown green, except that with the former a dead level surface is of paramount importance, while the chief requirement of the latter is an accurately contoured 'crown' which merges into the flat sides of the green without forming hollows.

DIMENSIONS

The regulation size of a crown green is 45 yards by 45 yards, but the nature of the game is such that it can be, and often is, played on a much smaller area. For the flat green, the laws of the game stipulate that a rink may measure not more than 21 feet and not less than 19 feet in width. An area measuring 42 yards by 42 yards will therefore provide six full rinks. Occasionally, however, it is necessary, owing to restriction of space, to lay greens of smaller dimensions, say 38 or 40 yards square.

One particular advantage in having a full-sized green of six rinks is that the direction of play can be changed immediately the ends of the rinks in use show signs of wear. It is also very advantageous to be able to move the rinks a foot or two sideways from time to time.

TURF OR SEEDS

A new green can be formed either by laying turf or by means of a sowing of grass seeds, and the question is one which is usually decided by financial considerations, as well as by the time which is available before the green is required for play. If a first-class playing surface is needed in the shortest possible time, the most satisfactory course is to lay sea-washed turf of good quality. Turf of this character is composed largely of a desirable form of Creeping Red Fescue (*Festuca rubra genuina*, var. *glaucescens*) and in texture is ideal for forming the keen surface essential for the game of bowls; moreover, its compact nature enables this turf to be laid with almost mathematical precision.

The use of sea-washed turf entails a large outlay, but there is no other kind of turf which is so admirably adapted to the requirements of a good green. The suggestion is sometimes put forward that the cost of a bowling green can be kept down by using inland turf, but we cannot subscribe to this procedure. We have at various times inspected bowling greens laid with inland meadow or down turf, and have usually found that much trouble has been experienced with coarse grasses

SUTTON'S BOWLING GREEN, READING. SOUTH AFRICA V. BERKSHIRE.



BOWLING GREENS

and weeds. Many of the latter are not visible when the turf is laid, and only materialise after the green has been down for several months. Furthermore, there may be difficulty in obtaining a true surface with inland turf, owing to differences in the characteristics of the various grasses of which it is composed and to its less compact nature as compared with sea-washed turf.

Where for any reason it is decided not to use sea-washed turf for a new green, the alternative is to sow grass seeds. Many excellent greens have been formed in this way, and the secret of success is thorough preparation of the seed-bed combined with the sowing of a really suitable prescription of grasses. Naturally, a mature green will not be obtained so quickly from seed as from turf, and the grass will require careful attention in the early stages. By using skilfully arranged prescriptions of seed, some remarkable results have been achieved in as little as six or nine months from sowing, but to be on the safe side it is as well to assume that the green will have to be maintained for the first summer without any return by way of games. All this must be taken into account when comparing relative costs. Nevertheless, subject to careful attention being given in the early stages, a perfectly satisfactory green may be expected from a sowing of grass seeds, and the initial saving of from £600 to £800 is always an important consideration.

SELECTION OF SITE

In selecting a site for a new bowling green, the main considerations are the type of soil, amount of shelter, accessibility, and water supply. Shelter is a *sine qua non* to enjoyable play and where none exists it may be provided in the shape of a fence or quick-growing hedge. As to water supply, it must be accepted that no green with an efficient drainage can be kept in good condition during the whole of an average summer without adequate means of watering, and watering points on opposite sides of the green are strongly to be recommended.

The quality of the soil is an important factor in the making of a sown or a turfed green. Light loam containing plenty of humus is the ideal, and any soil of a sandy nature is very suitable, provided it is not too open in texture and contains at least ten per cent. of clay and sufficient organic material. Lack of organic material can be made good with well-decayed farmyard manure or leaf-mould. But soil which is practically all sand or gravel is of no use, and success can scarcely be hoped for without importing a considerable quantity of fertile top soil.

Heavy loam can be improved by the liberal incorporation of clean sharp sand, but clay is about the most unfavourable medium upon which to endeavour to maintain a bowling green. Should the surface soil prove to be clay, or of an extreme type such as poor sand or gravel, it must certainly be rejected and better soil imported for making up the surface of the green.

Six inches of top soil is recommended for a sown green. In the case of a green which is to be turfed, the depth of top soil may be reduced to 3 or 4 inches and it often answers well to use sand instead of soil for the top inch, especially if the new soil is not itself of a sandy nature. As a rough guide, it may be reckoned that 60 cubic yards of sand or 70 cubic yards of soil will cover a full-sized bowling green to the depth of an inch, allowing for consolidation.

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FOUNDATION

There are not many sites for a new bowling green where an elaborate system of drains would be needed, but in our opinion it is essential to have an ash foundation not only for drainage but to assist in maintaining a true level and resilience of surface. The playing qualities of a green are always impaired by the absence of a proper foundation and it must therefore be regarded as an indispensable item of the construction work.

Clinker and ashes make the best foundation and the usual depth is 4 inches. Where the subsoil is retentive, the depth may be increased to 6 inches with advantage. Coarse clinker should be laid first, with finer material and ash on top, each layer being well consolidated by rolling and, if necessary, watering.

DRAINAGE

The ash foundation described above will be all that is needed to drain a light soil or gravel. In most other cases, one line of 3- or 4-inch drain pipes around the perimeter of the green, connected to a suitable outlet, will keep the ash bed free of excess water. A clay subsoil will require 3-inch drains laid across the green just below the ash foundation; these are usually spaced 15 to 20 feet apart, and may be laid diagonally across the green and connected to main drains of 4-inch pipes laid at the sides. Alternatively, a main drain could be laid across the centre of the green and branch drains let in at intervals on the well-known herring-bone system. When the pipes have been laid, the trenches must be well packed with small stones or clinker.

DITCHES

A crown green is not usually provided with ditches or banks, although a sanded area 6 or 9 inches wide may be left between the edge of the green and the surrounding boards, to hold 'dead' woods. For the flat green, it is necessary to form a 12-inch ditch around the playing square to catch any woods that overrun the green.

For many years, bowling green ditches have been formed by placing boards on edge with the tops an inch lower than the turf level. These boards are nailed to stout pegs and kept apart by struts placed across the ditch at close intervals. The space between the boards is filled with clinker or stone, covered with a layer of shingle or a wooden grating.

The scarcity of timber and its liability to rot and cause the edges of the green to sink has led to the adoption of an alternative method of constructing bowling green ditches by means of reinforced concrete sections.

BANKS AND VERGES

The banks surrounding a green are usually made about a foot higher than the playing surface and it is customary for the inner slope to be nearly vertical. This causes difficulty in the upkeep of the turf growing thereon, as it has to be cut by hand and in some seasons it suffers severely from drought. There is no reason why the bank should slope so steeply, and we consider an angle of 40 degrees is

BOWLING GREENS

quite sufficient. On such a slope the turf should thrive reasonably well and it is quite possible to mow it with a light roller machine.

Where a green is being turfed, the best plan is to lay the inner slope of the bank, together with a verge 1 foot wide at the top, with turf of exactly the same character as that being used on the green. Alternatively, the banks and verges may be covered with the best turf available locally, but in either case the turf on the slopes should be secured in position with small wooden pegs.

LAYING TURF

Turfing can be carried out from October to March, provided the weather is suitable. It is, however, an obvious advantage if the work can be completed by Christmas, so as to give the turf every chance of becoming well established by the following spring. The turf should be laid in diagonal courses by an experienced bowling green turfer, each piece being carefully set in position and properly consolidated but not beaten down. As laying proceeds, a dressing of sand or fine soil should be brushed into the turf to fill any joints and when the whole of the green is covered it should be carefully rolled to make the surface fairly firm.

AFTER-TREATMENT OF A TURFED GREEN

After turfing, the surface should be left undisturbed for six weeks or more, in order to give the roots of the grass every opportunity of penetrating well into the underlying soil. Subsequently, the roller may be brought into use as frequently as weather conditions permit. The best time for this work is when the surface has practically dried off after rain.

An occasional light sweeping or switching will be found useful, and about 3 tons of sharp sand in early spring will assist in preparing the surface for play. As soon as growth starts, give a dressing of fertiliser; a good compound artificial is usually applied at the rate of 2 ounces per square yard, amounting to 2 cwt. for a full-sized green.

SOWING GRASS SEEDS

Grass seeds may be sown in spring or autumn, but in considering the most suitable time for sowing a bowling green it must be borne in mind that the seed-bed overlies a foundation of ashes and after a period of hot, dry weather, such as is often experienced in spring, the surface soil becomes parched. It is then necessary to water, with consequent risk of damage to the face of the green if the turf is only just beginning to materialise.

Another point is that all fertile soils contain weed seeds in abundance, and if these are given no opportunity of germinating before grass seeds are sown, the development of the new turf may be seriously checked by weeds. The ideal procedure is to carry out the constructional work in spring or early summer, and let the seed-bed lie fallow for a few weeks. This should provide opportunity for the destruction of weeds, in addition to letting the foundation and surface soil become well consolidated.

In September, the ground is generally warm and moist enough to ensure the rapid germination of grass seeds, and under normal conditions the young turf

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will make considerable headway before winter. It may even be possible to mow the green a few times before growth stops. Where circumstances permit, therefore, preference should be given to autumn sowing.

PRESCRIPTIONS OF GRASS SEEDS

To produce a green closely resembling sea-washed turf, it will be necessary to sow our 'Cumberland Turf' Mixture, containing seed of Sea-washed Creeping Red Fescue, the grass to which the unique quality of Cumberland turf is due. Such a prescription is a little more expensive than the usual lawn grass mixture, but the additional outlay is well worth while. Where, however, it is impracticable to incur the extra cost, other mixtures which will produce bowling green turf of quite good quality can be obtained, but it is essential that they be restricted to the finest growing types of grass and on no account should Perennial Rye Grass or other strong-growing species be included.

For a full-sized green we recommend sowing 2 cwt. of grass seed, equivalent to approximately 2 ounces per square yard. This is usually enough to produce a dense turf within a reasonably short period. Where time is not important, this quantity might be reduced a little, but it must be borne in mind that a good seeding not only ensures rapid development of the turf but also assists in suppressing indigenous weeds.

AFTER-TREATMENT OF A SOWN GREEN

When the grass is 2 or 3 inches high, roll it very carefully with a light roller. A wooden roller such as is employed to give a finishing touch to putting greens is ideal. In a day or two, the turf will be ready for its first cut which should be done either with a scythe or a light, free-running mower with the knives set high. Subsequently, the usual hand mower may be brought into action, still keeping the knives fairly high. To encourage rapid tillering, the grass must be mown frequently, but it is of the utmost consequence to guard against cutting the young turf very closely during the first few weeks. By the end of June or early in July the height of cut may be gradually reduced, but for the whole of the first season of growth the turf should never be mown so closely as an established green. The correct treatment to produce a dense turf in the shortest time is frequent mowing, but at a moderate height.

After the first few times of mowing, the surface may be rolled, first down and then across the green, drawing the implement very steadily. We may here mention that for this particular work and throughout the life of the green, only a roller of approved type should be employed. The most suitable pattern has open ends, and a large and accurately turned face so that it moves slowly on the green and gives the maximum result with a minimum of friction. A useful weight for the roller is between 4 cwt. and 5 cwt.

Rolling may be continued as necessary, always choosing a time when the surface of the green has dried off after rain. It is important at all times to avoid damaging the grass in turning the roller; trifling depressions may occur in a sown green while the grass is developing, and these may be made good by *light* dressings of sand, or a mixture of sand and clean sifted soil.

THE UPKEEP OF BOWLING GREENS

THE SATISFACTORY upkeep of a bowling green demands expert supervision and the undivided attention of the greenkeeper. Everything possible must be done to maintain a close, healthy turf and it is important at all times to guard against any disturbance of the true level.

MOWING AND ROLLING

The maintenance of a true and even surface depends largely on the discriminate use of mower and roller, and in this connection the information given at pages 31 and 32 on the general upkeep of lawns will be a guide. All we need say here is that the best mower for a bowling green is a free-acting machine with a specially thin cutting plate. When the grass is growing freely it may be desirable to run the machine over every other day, each cutting to be followed by a light rolling. In the height of summer there will be less need for frequent mowing, and as the herbage decreases under a hot sun the cutters should be raised a little. When the green is out of play the plant should always be kept fairly short, otherwise it may deteriorate in quality.

Bowling greens must be rolled frequently, but this is an operation to carry out with some care as the injudicious use of a heavy implement would cause injury. It is not advisable to roll during winter, but there are many occasions in March and April when rolling will do much good in the preparation of the green for the coming season. The best time for this work is when the surface has practically dried off following rain, and if full advantage is taken of such opportunities there will be far less need for a great deal of rolling during the playing season.

Before rolling, any worm casts present should be well broken up and evenly distributed by sweeping or switching. The practice of rolling-in worm casts is strongly to be condemned, as nothing contributes more to the presence of a muddy surface and the formation of numerous bare and thin spots.

A special single-cylinder open-ended roller, as described on page 32, is the usual implement for a bowling green, although a special light roller may be put over to give a finishing touch to the rinks before play.

WATERING

Adequate watering is of great importance. Bowling greens drain rapidly, and even during a short spell of dry weather the grass turns brown if water is withheld. Further information on this subject will be found on page 33.

TOP-DRESSING

Close attention must always be paid to top-dressing. Under the influence of rapid drainage, as well as constant watering during dry weather, the surface soil loses much of its soluble plant food, and unless further supplies are forthcoming the grass soon deteriorates. It is usually accepted as a general principle that bowling greens need fertiliser both in spring and autumn as well as one or two light dressings during the actual playing season.

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Bone meal is sometimes recommended as a suitable artificial for bowling greens, but in our opinion a more complete form of fertiliser is essential to satisfy all the requirements of the turf. For use in spring, 2 ounces per square yard of a mixture of both organic and inorganic materials is recommended, but in the autumn the use of organic fertilisers alone will be more suitable.

The summer dressings may consist of $\frac{1}{2}$ -ounce per square yard of a mixture similar to that used in spring, or a $\frac{1}{4}$ -ounce per square yard of finely-powdered sulphate of ammonia if it is desired to give the turf a rapid stimulant or discourage clover. These small dressings may be given in May, June or July and should be carefully bulked with sand or another suitable carrier in order to ensure even distribution. If the weather is not showery, they may be put on in the evening and well watered in.

EARTHWORMS

Notwithstanding the clinker foundation, earthworms often find a way into bowling greens, and should be dealt with whenever they are at all numerous. Recommendations as to the most suitable forms of worm destroyer will be found on page 47.

WEEDS

Weeds and clover should never be tolerated in a bowling green, and it is possible to deal with these to some extent with 'selective' weed killers during the playing season. (See also Chapter 11.) It is equally important that coarse grasses be kept out. Plants of Perennial Rye Grass and Rough-stalked Meadow Grass are only too ready to establish themselves from seeds dispersed by the varied agencies of nature, and isolated plants of these grasses should be removed as soon as they are observed. Another grass which should always be kept out of fine turf is Yorkshire Fog, which can generally be distinguished by its soft pale green foliage. The patches are very noticeable and should be cut out in the autumn, otherwise they will increase in size from year to year.

Annual Meadow Grass will almost certainly find a way of becoming established in a bowling green and may be dealt with by hand weeding if the plants are not very numerous. Unfortunately, however, it is not always easy to detect the presence of this grass, and owing to the freedom with which seed is produced it quickly becomes an integral part of the turf. Annual Meadow Grass starts growing much earlier than many other grasses and seeds abundantly in spring, so that it is somewhat conspicuous in the early part of the playing season if present to any extent in a bowling green. Later on it becomes far less noticeable, and being of a reasonably fine-leaved habit there is not the same objection to it as there would be in the case of the other species mentioned.

AFTER-SEASON TREATMENT

After a season's play it is only to be expected that a certain amount of renovation will be needed. Players are naturally averse to surrendering the green so long as favourable weather lasts, but for the future welfare of the turf play should cease before the end of September to allow time for the necessary repairs. Should there be an appreciable amount of re-sowing to do, it is advisable to close the green at the beginning of that month.

THE UPKEEP OF BOWLING GREENS

The first step should be to go carefully over the surface and remove all weeds and coarse grasses, following which the entire green should be well scarified with sharp rakes or by means of a mechanical rake. Sweep up and remove loose stems, or collect them by running a mower over with the knives set high. The autumn dressing of organic fertiliser may next be given and thin places through the green repaired by sowing seeds of a prescription arranged to match the existing turf. Lightly rake in the seed and follow with a dressing of sharp sand or clean sifted soil.

Any large bare patches at the sides of the green should be repaired with turf, and for the purpose a turf nursery should be maintained in similar condition to the surface of the green.

As regards aeration bowling greens need special consideration, in particular, those which have been laid with sea-washed turf. In spite of rapid drainage there is always a risk of the surface becoming hidebound and this is intensified if artificial watering has to be carried out to any extent. When the season is such as to necessitate a considerable amount of watering, it is as well to limit rolling to the minimum.

The hard surface which results from constant traffic and rolling, or watering, will not be fully relieved until the green has been thoroughly aerated, and this may be done during an open spell in autumn or winter by driving in the tines of a specially-made fork at close intervals all over the green. Hand-forking in this way is usually the most effective means of aerating a bowling green, although some efficient machines with hinged tines have been devised and are very useful where time is of importance.

A hollow-tined fork or machine is recommended if the surface is particularly hard, otherwise the solid tine will do good work.

Aeration is commonly followed by a dressing of sharp sand and it has been the practice to use as much as 10 tons for a full-sized green; in the majority of cases, however, 5 tons to 6 tons is ample. An even better dressing would be 3 tons of sand mixed with 2 tons of screened fertile soil. There is, of course, the danger of introducing weeds, but this can be minimised by sterilisation or by obtaining the soil well in advance and turning it over several times before use to destroy weeds as they spring up from seeds present in the soil.

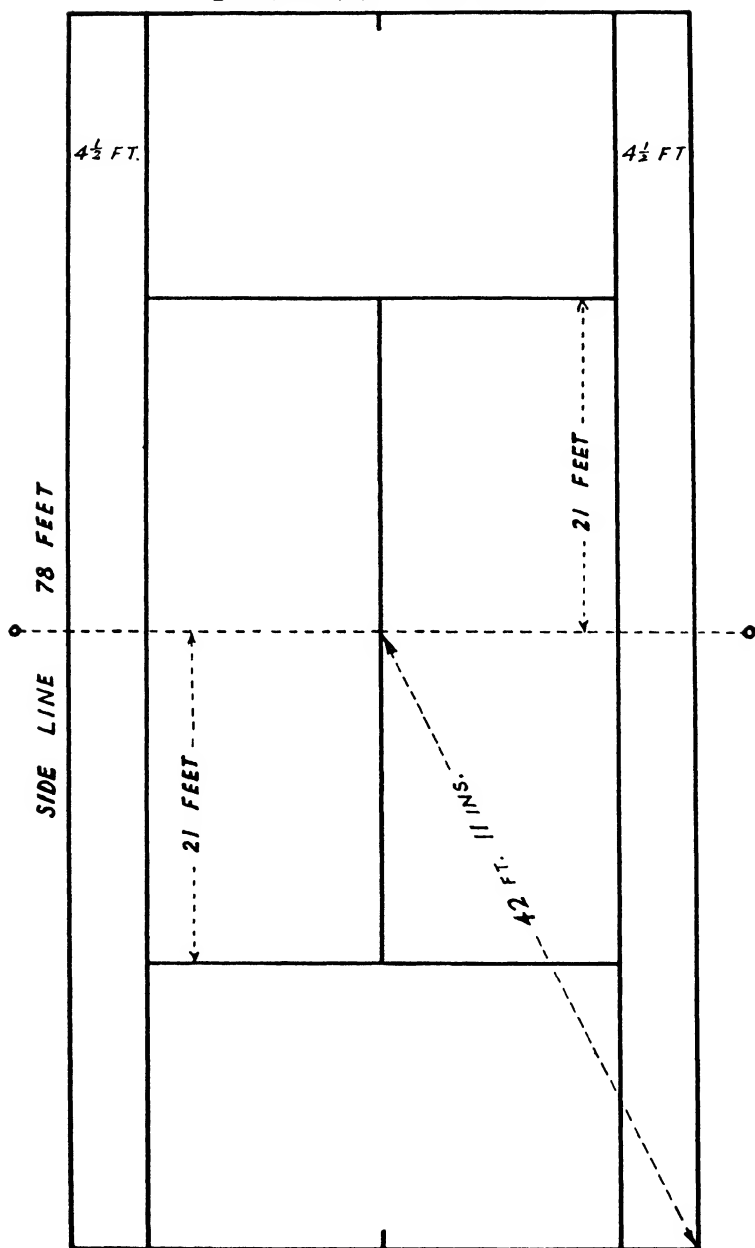
The ordinary spiked roller with short fixed tines is of little value for deep aeration but may be put over occasionally during the playing season to assist in keeping the surface open. It is also of value if used prior to watering or fertilising.

During winter, the turf will need little attention apart from aeration, but the grass may be 'topped' occasionally with the mower set high if the weather is not too severe and the grass is getting rather long. Worm casts should be broken up by brushing or switching whenever the ground is dry.

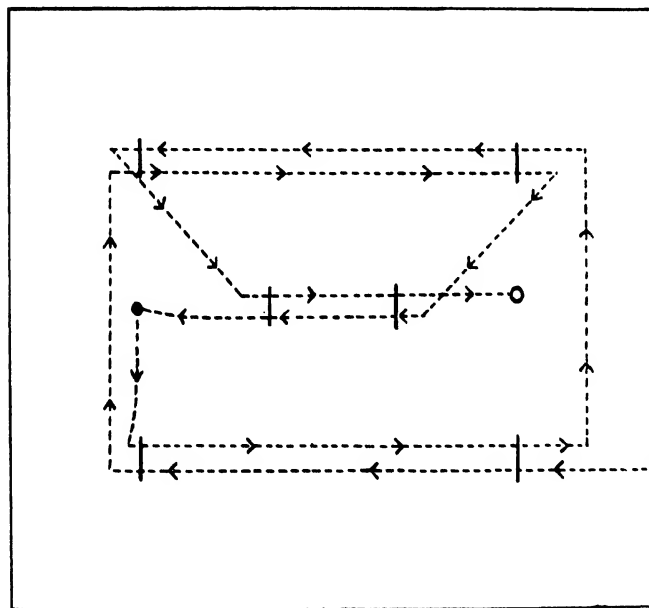
One final word. Much can be done to preserve the original character of a bowling green by constant light renovation with a prescription of seeds carefully arranged to match the turf. On the other hand, the employment of an unsuitable renovating mixture can result in serious, if not permanent, damage, so that too much attention cannot be paid to this important point.

PLAN OF DOUBLE TENNIS COURT

BASE LINE 36 FEET



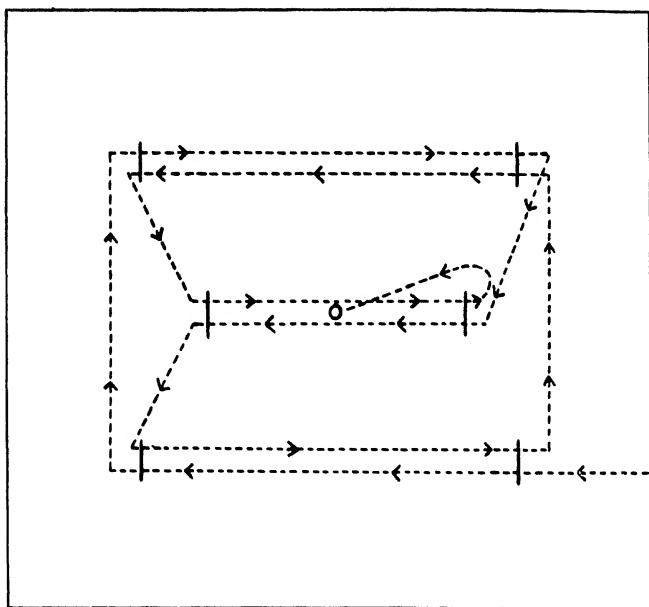
PLANS OF CROQUET LAWNS



Setting No. 1.

Pegs in centre line of lawn 7 yards from nearest boundary; hoops up centre line of lawn 7 yards from nearest boundary and 7 yards apart; corner hoops 7 yards from centre line and 7 yards from nearest boundaries.

N.B.—The direction of play is indicated by arrows. The hoops are shown by short black lines, the turning peg by a black circle, and the winning pegs are shown by a small white circle.



Setting No. 2.

The turning peg is omitted. The winning peg is equi-distant from the four corners, and the two central hoops are placed on the central line, 7 yards on each side of the winning peg. Corner hoops as for Setting No. 1.

The diagram illustrates the layout of a football field, focusing on the goal area and the half-way line. The field is bounded by a **TOUCH LINE** on the left and right sides, and a **GOAL LINE** at the top. The **HALF-WAY LINE** runs horizontally across the center of the field.

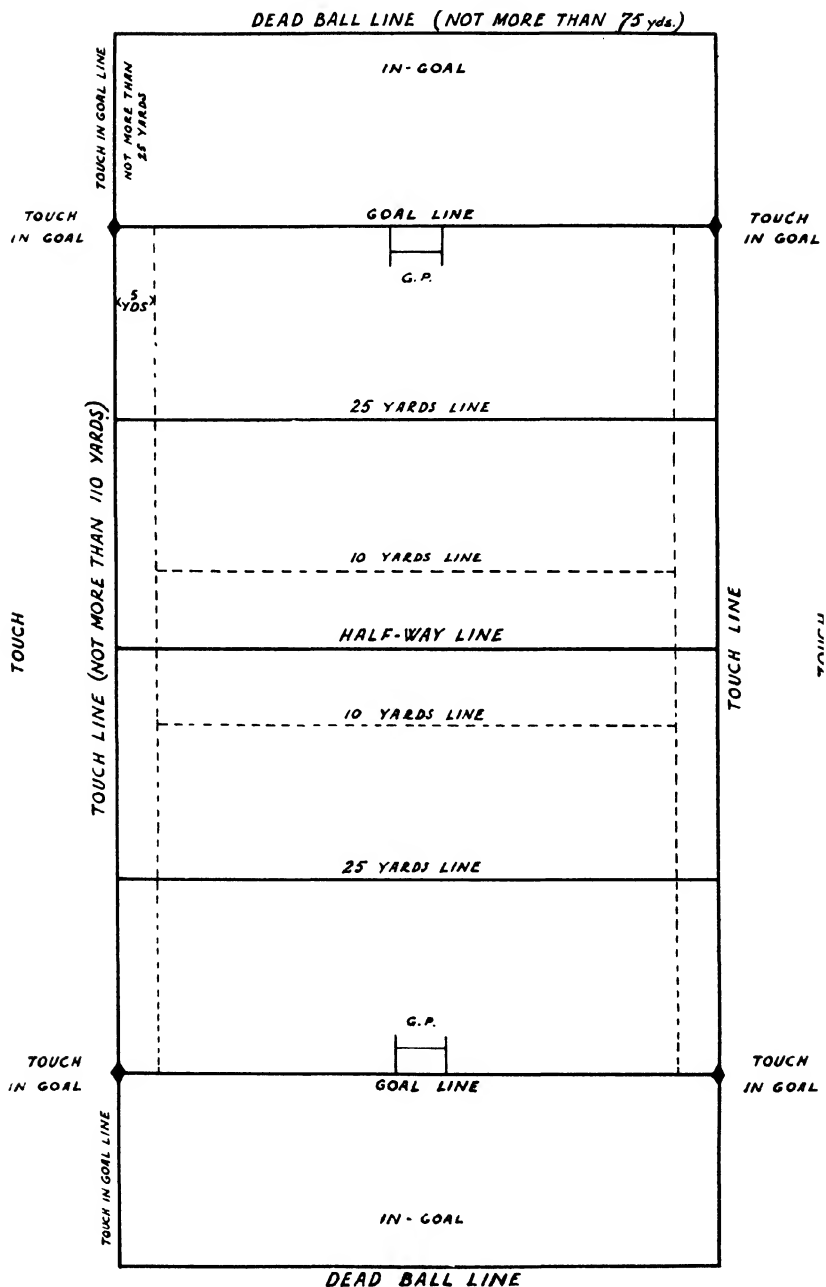
At the top of the field, the **GOAL** is located within the **GOAL AREA**. The **PENALTY AREA** is defined by a semi-circular arc with a **10 YARDS** radius, centered on the goal line. The distance from the goal line to the center of the goal is marked as **6 YARDS**.

In the center of the field, a **CIRCLE 10 YARDS RADIUS** is shown, centered on the **HALF-WAY LINE**.

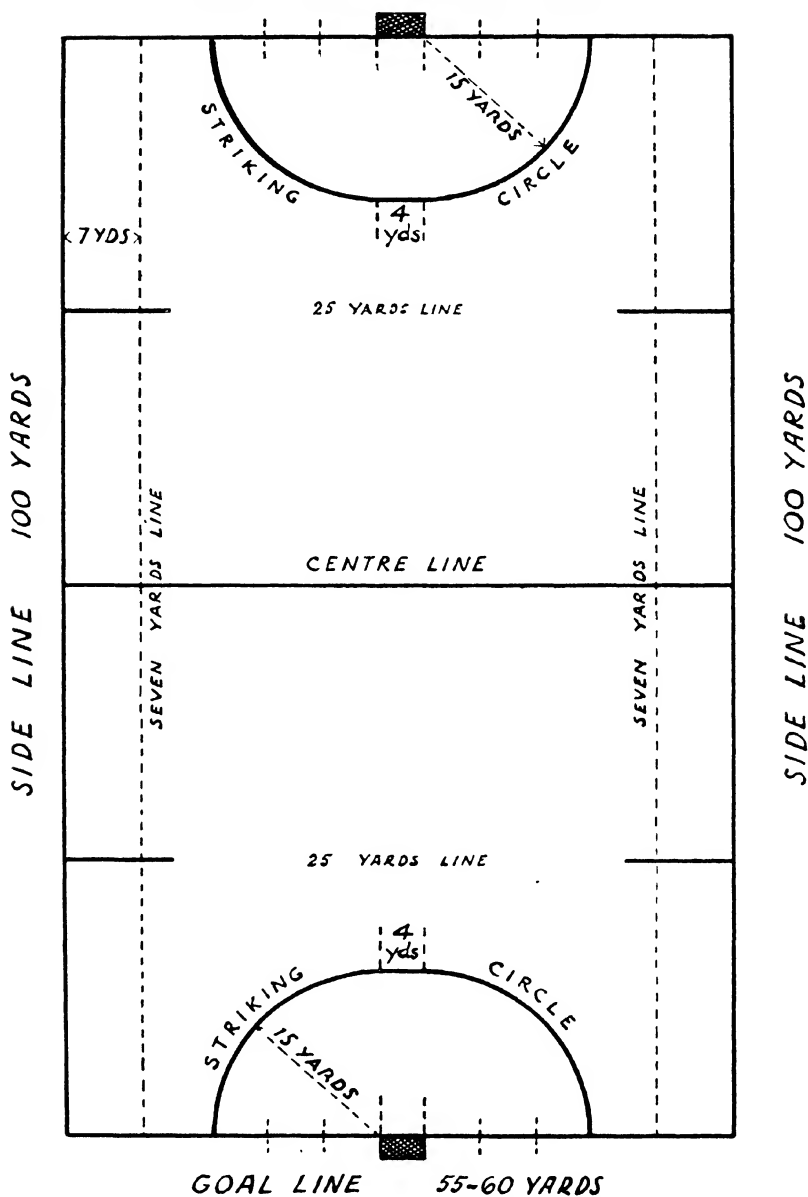
At the bottom of the field, the **PENALTY AREA** is shown as a rectangular area measuring **18 YARDS** in width and **20 YARDS** in depth. The **GOAL AREA** is a smaller rectangular area within the penalty area, measuring **6 YARDS** in width and **10 YARDS** in depth. The goal is located at the center of the goal area. The distance from the goal line to the center of the goal is marked as **6 YARDS**.

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PLAN OF RUGBY FOOTBALL GROUND



PLAN OF HOCKEY GROUND GOAL LINE 55-60 YARDS



The flag posts at each end of the centre line and at each end of the 25 yard lines must be 1 yard outside the side lines.

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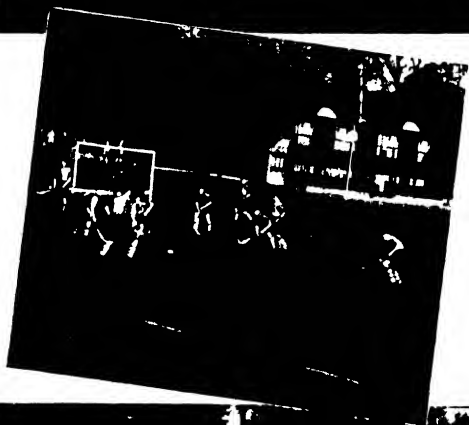


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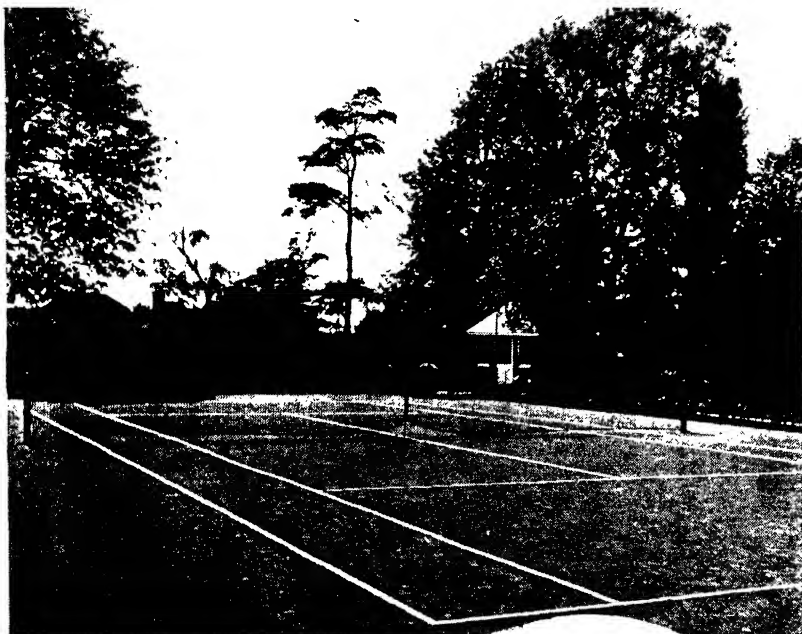
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